The Electrical World.

VOL. XXVIII. NEW YORK, OCTOBER 3, 1896. No. 14.

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY,

253 Broadway, New York.

Established 1874. Incorporated 1889.

Telephone Call: Cortlandt 924. Cable Address: "Electrical," New York

New England Office, 620 Atlantic Ave., Boston.

Western Office, 936 Monadnock Block, Chicago.

Philadelphia Office, 927 Chestnut Street.

SUBSCRIPTION IN ADVANCE, ONE YEAR, $3.00,

in the United States, Canada or Mexico; other foreign countries, $6

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THE ELECTRICAL WORLD,

253 Broadway, New York.

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AVOIDABLE ACCIDENTS ON STREET RAILWAYS.

With the introduction of the electric railway and the consequent increase in speed, a grave responsibility was placed upon the officials of companies adopting the improved system of street travel. The change in existing conditions resulted in many serious accidents, not only on account of high speeds, but also to the carelessness and want of judgment on the part of the victim and the motorman. It is a great problem with street railway managers to reduce the number of accidents to a minimum and one which was carefully treated by Mr. W. W. Cole, at the recent convention held in Binghamton. The author concludes that the best preventives of avoidable accidents are to be obtained only by employing efficient employees. He outlines a method of examination of applicants and states the qualifications essential in an efficient motorman, all of which qualifications, however, few possess. The men can doubtless be educated to do and accomplish things which they previously thought they were incapable of doing, but the best results are to be obtained by paying capable men well for their services. There is probably no better way to avoid accidents than to place on the front platform an intelligent, careful and competent motorman.

THE TRANSMISSION AND DISTRIBUTION OF ELECTRICAL ENERGY.

The inaugural address of President Duncan on the "Present Status of the Transmission and Distribution of Electrical Energy," delivered before the Institute on Wednesday evening, Sept. 24, although chiefly a *résumé* of existing or possible methods, set forth in a careful and interesting manner the features likely to be attained with the various known systems, the advantages and disadvantages of each and the probable future line of development. In a paper having such a wide scope it was, of course, impossible to treat with any degree of detail the several possible methods of transmitting and distributing electrical energy. One omission, however, which we noted in connection with the use of the storage battery for electric railway purposes was that of carrying the battery upon the locomotive and operating it in parallel with the motors and line feeders. There are several advantages to be derived in the adoption of this method as compared with the method of placing the battery either in the central station or having it divided and located at various points along the line. The former practice, although it allows of a constant load upon the engines—one of the most desirable features in connection with the use of the battery—still requires the feeders to carry a variable load depending upon the demands of the traffic. Placing batteries at various points along the line eliminates the variable load on the feeders, but unless there are a comparatively large number of battery supply points, the variations on the distributing conductors still become excessive. At the same time in case the cars are stalled at any particular point, the entire load will have to be carried by the batteries at that point when the traffic is resumed. These defects are obviated by placing the battery on the locomotive, it being supplied at the same time from the feeders. By this method the battery is carried to those points along the line where the demands upon it are greatest. If several trains are stalled, or if one is mounting a grade while another is descending, one will be to a large extent assisted by the battery of the other. The load on the feeders and therefore at the station is a constant as with the other systems. The feeders may therefore be calculated for the most economical drop, and will be

considerably smaller than if carrying a variable load. They may be so designed that with the maximum number of trains the batteries will charge when approaching the power station and discharge as the trains approach the end of the line. In fact, the line feeders could be entirely done away with at the most distant points, leaving to the battery the entire load. The batteries necessarily keep the potential at the locomotive practically constant, an important feature from the motorman's standpoint, inasmuch as each point on his controller means as much at one time as another. Where crossings occur and at other points when so desired, the battery may be left to take care of the load, thus avoiding complicated switching construction. It would appear that this method offers several important advantages over the other methods proposed. President Duncan correctly distinguished between the storage batteries to be used on railways and those designed for lighting purposes. The above method, like that of carrying a battery on each car without the use of line feeders, is limited by the fact that the successful storage battery for these purposes has not apparently made itself known. The rapid development and extensive use which it has met with in the lighting field certainly offers encouragement, and it is to be hoped that it will soon successfully demonstrate its value and certainty of operation in the railway field as well.

CATHODE AND RÖNTGEN RAYS.

The reports at hand of the Liverpool meeting of the British Association for the Advancement of Science show that the meeting was most successful, both in the number and prominence of its attendants and also in the quality of the papers read. Prof. J. J. Thomson, president of the Mathematical and Physical Section, in his address treats of several subjects, but discusses principally Röntgen's discovery and the probable nature of cathode and Röntgen rays. The address is noteworthy for the clear and forcible manner in which it sets forth the various theories regarding vacuum-tube phenomena. Of the two views held regarding the nature of cathode rays, namely that they consist of particles of the residual gas contained in the tube moving at a high velocity, each particle carrying a charge of negative electricity, and second, that they are waves in the ether, he believes that the former, now the generally accepted view, is the true explanation and not in opposition to the discovery of Lenard of rays existing just beyond the aluminum window of his tube, which are assumed to be due to convection currents of electricity in the air rendered a conductor by the Röntgen rays, the currents being similar to those within the tube itself. That the cathode rays are due to negatively charged particles of the residual gas there remains little room to doubt. It is very difficult to account for, if not inconceivable, that the cathode rays should consist of vibrations of the ether and how they would, if such, negatively charge a metal tube placed within an exhausted vessel, as shown by Perrin's experiment, or why they should be deflected in a uniform magnetic field. Inasmuch as the character of the cathode rays depends upon the degree of exhaustion of the tube, it would seem that they are independent of ether vibrations, although such may exist. It is also noteworthy in this connection to observe that the charged gas particles cannot pass through the walls of the tube as frequently advanced as an explanation of the Lenard rays. This fact is brought out by Prof. Stine in other columns of this issue, in which he shows that by the method of reversal it is possible to completely restore a tube to its original condition without heating or re-exhausting as formerly practiced. This depends upon the anode being of some size comparable with that of the cathode. Thus, by occasionally changing the direction of the discharge, a tube may be maintained in a condition giving the maximum Röntgen-ray effect. This makes the original degree of exhaustion to a large extent independent of the maximum effect point inasmuch as the same may be attained after some use. The experiments of Prof. Stine conclusively disprove the previous hypothesis to the effect that projected material particles pass from the cathode through the walls of the tube, an hypothesis which had, it must be admitted, little common sense for a basis. In considering Röntgen rays, Prof. Thomson believes that all phenomena known in regard to them are not incompatible with known facts concerning some phenomenon of light. The remarkable discovery of Becquerel, that uranium salts and some other fluorescent substances emitted invisible radiations possessing the property of being polarized, and at the same time similar to the Röntgen rays in their ability to penetrate opaque substances, seems to add one of the most conclusive proofs that Röntgen rays and light are one and the same. The absence of refraction and polarization are points not to be advanced as disproving this conclusion, especially when considered in connection with the Helmholtzian theory of dispersion. Prof. Thomson very clearly and lucidly explained this theory, showing how the refractive index at first increases with the frequency of light until the latter is equal to the frequency of the natural period of vibration of the refractive substance; then diminishes and becomes practically equal to unity when the frequency of vibration of light is much greater than that of the molecule of substance, the assumption of Helmholtz being that the molecule of the refractive substance consists of two oppositely electrified atoms and that the specific inductive capacity of the medium is made up of two parts, one due to the ether and the other to the molecules of the substance, arranging themselves along the line of electric force. Although these facts have been clearly enunciated during the past few months, it seems that they are just beginning to be realized and appreciated.

ARE THE TROLLEY AND CABLE SYSTEMS DOOMED?

Under the heading "City Traction Systems," Lieut. F. Jarvis Patten contributes to the October number of *Leslie's Monthly* an article unique in its way and one which would, should the opinions therein expressed be regarded seriously by street railway managers, land these officials in the midst of a widening sea of doubt and distraction sufficient to cause their hair to turn gray. Lieut. Patten has placed himself squarely upon a platform having for its cardinal virtue the petroleum motor as a means of propelling passenger vehicles through city streets. He boldly asserts that the horseless carriage driven by a gasoline or petroleum motor is going to effect an industrial revolution and rid the earth of trolley systems, cable systems, and in fact all systems of propulsion now in vogue. Lieut. Patten is evidently a firm believer in the future of this class of passenger service, and only time can tell whether his ideas will be carried out to the extent which he predicts. In the present stage of its development it would be hard to judge of the future possibilities of the horseless vehicle and the extent to which it will become a factor for transportation in city thoroughfares. The roseate view regarding the petroleum motor held by Lieut. Patten is, however, certainly not justified if we may assume existing conditions as any criterion. The successful motor, it is safe to say, will depend upon some other form of energy than that which is at present apparently the most successful, so that the revolutionary views which Lieut. Patten sets forth are not likely to receive for several years to come any material substantiation. The fact that any engine of this kind is oscillatory in its motion together with the disagreeable odors which arise from the use of oil and discharged gases are sufficient to condemn this form of energy. It is quite probable that the future street vehicle for the transportation of passengers will be operated on smoothly paved streets and entirely independent of any track construction. This day, has, however, by no means been reached, a sufficient justification for the belief that Lieut. Patten's view of the situation will have but little effect upon the hard-headed street railway manager, who is not so easily moved by enthusiasm.

The British Association.

(By Cable from Our Special Correspondent.)

The annual meeting of the British Association for the Advancement of Science, which was held in the Philharmonic Hall, Liverpool, on Sept. 16, 17, 18, 21, 22 and 23, was an unqualified success. There was a very large attendance, estimated at 3000 persons. Among them were several persons of prominence in the scientific world, including Prof. Frederick Kohlrausch, Prof. Philip Lenard, Prof. Bjerknes, Prof. Elster and Prof. Geitel.

Sir Joseph Lister was introduced by the retiring president, Sir Douglas Galton, and read his presidential address. Sir Joseph referred to the valuable aid given to surgery in the use of Röntgen rays, and to the effects of these emanations on the skin if long exposed to their action. These effects he thought suggested the idea that the rays could produce injurious irritation or salutary stimulation according to the condition of the parts subjected to the action.

The address was entirely devoted to the consideration of the interdependence of science and the art of healing.

The address of Prof. J. J. Thomson, president of the Mathematical and Physical Section, reviewed the advances made in these sciences during the past year which have been rich in matters of interest to the physicist. He referred at great length to the discovery of Prof. Röntgen, and reviewed the work that had been accomplished as a result of this discovery.

There were several debates on the subject of Röntgen rays, during which was developed a great diversity of opinion between English and Continental authorities as to the nature of these rays.

The proposition to establish a national physical laboratory was brought before the meeting and adopted. It was also decided to ask the Government for funds to further this object.

American Institute of Electrical Engineers.

The first meeting of the season of the American Institute of Electrical Engineers was held on Wednesday evening, Sept. 23. President Duncan delivered his inaugural address, the subject of which was the "Present Status of the Transmission and Distribution of Electrical Energy." The various methods applicable for the transmission and distribution were reviewed and presented in a manner such as to be of much interest to those present. The president stated that he believed in the use of the most advanced types of triple-expansion engines for large electric lighting stations, but for railway purposes the compound engine, or perhaps even the simple-expansion type, was to be preferred. He considered that batteries suited for lighting stations were not the best for traction purposes, so that a distinction should be drawn between the two.

Where a small quantity of energy was to be transmitted, the continuous-current series system was perfectly feasible as has been demonstrated by M. Thury in several plants of this kind abroad, but for large powers necessitating a considerable current, alternating-current systems only could be used with success. The fact that no single-phase motor of a respectable size exists reduces the problem to the relative advantages of the two and three-phase systems.

The use of rotary transformers and storage batteries in operating electric railways supplied from distant points was considered in its different phases, the former being built to overcompound with increase of load. The discussion was participated in by Messrs. Steinmetz, Wolcott, Perry, Ries and others. A full report of the address will be published in a subsequent issue.

The Phonograph in Court.

The two suits of the American Graphophone Company, Washington, D. C., against the Edison Phonograph Works, and the United States Phonograph Company, came up for a hearing before Judge Green in the United States Circuit Court at Trenton, N. J., on Sept. 22. These suits are based on two patents dated May 4, 1886, and involve the method of engraving the record of the sound waves on a cylinder or other tablet of wax-like composition. The hearing ran through the succeeding day, Sept. 23. These suits have been pending for several years. The counsel were Richard M. Dyer and Samuel O. Edmunds, of New York, and Howard W. Hayes, of Newark, for the defendants, and Philip Mauro, of Washington, for the plaintiff.

Röntgen-Ray Tubes.

BY W. M. STINE.

The mass of literature which has accumulated concerning the various Röntgen and Crookes phenomena has been enormous, and naturally makes the scientific contributor reticent in adding to the volume. Yet experimental results and observations based on them, when thoroughly worked out and carefully matured, are deserving of record and attention whatever be the time or subject.

With due deference to those writers who have from time to time proposed a *standard* form of tube, such a one has not yet been evolved, and the probabilities are that there exists no real necessity for it. As the applications of the ray are extended and we grow to know more of its power and nature, the design of the tube must vary in conformity with especial needs. At the most, the writings and experience of trustworthy experimenters can furnish guidance only for the design of tubes.

Glass-Impact Tubes.—This, the first type, has now been pretty thoroughly studied, and has been discarded by many. But numerous useful points in design may be learned from it, and we shall see its era of usefulness has by no means ceased. Early in the development of this interesting subject the writer published some general directions governing the design of this class of tube. Since then tubes made in accordance with these suggestions have been produced in some numbers and used sufficiently to show the correctness of the principles laid down. Extensive observation now justifies the repetition of these principles with added emphasis.

The general plan of the tube is seen in Fig. 1. It will be noticed that the cathode is placed in a narrow neck of the bulb. The essential point is that the cathode disc shall almost completely close the neck. The result is that nearly all the electrical energy imparted to

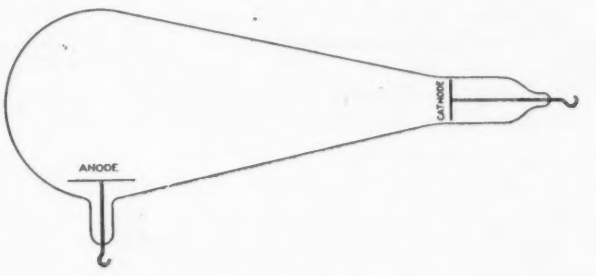


FIG. 1.

the disc is radiated from its front, since the residual gas is largely prevented from getting access to the rear of the disc. This means higher efficiency. In cases where the cathode has been inserted well into the bulb the writer has found the tube walls about the cathode to heat so badly as to either injure the tube or prevent the use of higher potentials on it. Whatever be the type of tube, it is recommended that the cathode be let into a neck, the opening of which it closes to within one-eighth inch of the walls. A very general mistake has been made in the shape of the anode. Too often it has been only a wire, presenting a small surface for action. The anode should be a *disc*. As to the metal to be used, the cathode is invariably of aluminum, and this metal answers perfectly for the anode. As to the sizes of discs, the anode should be larger than the cathode. For this type of tube the best sizes seem to be, cathode, three-fourths inch in diameter, and the anode one and one fourth inches. Investigation of the influence of the shape leads to the conclusion that the anode should always be flat. A concave cathode should not be employed, for it unduly heats the glass, and since it cannot be used with high potentials, prevents the tube from being worked up to its full power. A flat cathode has so far given the best results A slightly convex cathode has given excellent results, though it has not proven superior to the flat. The length of the pear-shaped bulb is of considerable importance. It must not be too short, the proper distance from the cathode to the end of the bulb being from eight to ten inches. The value of this suggestion lies in the greater length, permitting the cathode stream to diverge slightly, producing a larger impact-surface, and ensuring the tube shall work cool. It is usually stated that the particles of the cathode stream move rectilinearly; but if the stream consists of similarly charged particles, the path must be parabolic. This divergence is an experimental fact, since the anti-cathode area is always larger than the disc.

When pumping the tube the vacuum should not be carried too high. Previous to the sealing-in of the electrodes, the careful maker will heat the discs to drive off the occluded gas, and seeing to it at the same time that they are perfectly clean. A finger mark on them has been found to seriously interfere with the action of the tube. The tube should also be carefully heated before pumping, and should be excited from time to time while on the pump, and care must be taken to reverse the electrodes for equal times. The proper vacuum for sealing is indicated when the fluorescence assumes a greenish tinge and the fluoroscope screen is feebly illuminated. The tube may then be "built up" by feeble excitation for eight or ten hours, until the blue light first noticed has well disappeared. A tube is thus produced which should work with perfect satisfaction on a coil excited from two or three cells of storage battery.

These details may seem to be tediously minute; yet they are given mainly for their bearing on the question of reversal.

It is a well known fact that tubes of any character in which one or more metallic electrodes are employed will show an increasingly high vacuum when in use. A remedy used by some is to heat the tube gently, and it is a common practice to open the tube and repump it. Both these expedients are unnecessary, since the tube, if not too highly exhausted originally, will lower its own vacuum by reversal, provided the anode is a plate of some size. If a tube, constructed as in Fig. 1, be reversed, it will fill with a peculiar blue light with marked yellow fluorescent patches on its walls. The fluoroscope indicates the absence of all Röntgen rays. If this is continued for too long the tube again becomes active, and the reversal is permanent. Whenever the vacuum is discovered becoming too high it will suffice to reverse the polarity for a few minutes. If careful attention be paid to this, the vacuum will remain practically constant throughout the life of the tube. The function of the anode disc is thus two-fold; it materially shortens the time required for building up a tube, and affords a means for regulating the vacuum. Just how this is accomplished may be open to question. Undoubtedly it is in part an occlusion of the residual gases, but the fact that it is associated with a definite polarity indicates that the gases are driven in electrically. There is a suggested resemblance here to electrolysis. If any facts were needed to correct the assumption that the Crookes tube may be exhausted electrically by the propulsion of minute particles through the tube walls, these certainly furnish the disproof of the assertion.

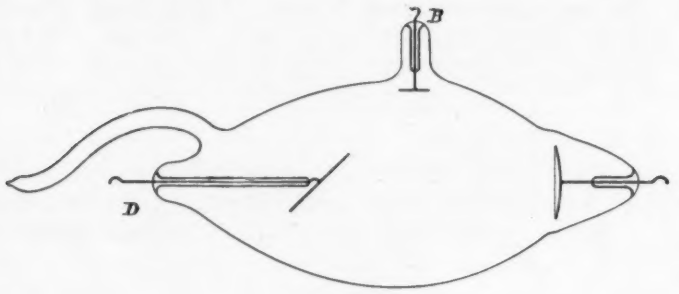


Fig. 2.

Certain phenomena connected with the cathode have already been noticed, but not fully discussed. After a tube has been in use for some time a series of concentric rings will develop on its surface with the head of the rivet of the leading-in wire as a centre. Continued use causes the series to increase in diameter and grow more sharply defined. If they are examined by very obliquely incident light they present much the same appearance as Newton's rings. As an inference from the sooty deposit on the anti-cathode wall, these rings are due to the tearing off of the metal from the surface of the cathode. If the rings be closely watched during the early life of the tube they may be seen developing from their centre. Associated with this is an appearance which would seem to indicate an inertia effect of the electrical discharge. In the early stages a faint axis of blue light extends from the cathode to the tube wall. This is probably caused by the stream of metallic particles, but it serves to show that in such high vacua the discharge occurs from the centre of the disc. Accordingly to the ordinary conception of the potential of plates the discharge should occur from the edges of the disc. The distinction between the condenser action of a plate in low and high vacua is beautifully shown if a tube happens to puncture when in use. The first effect is to fill the bulb with a brilliant purple glow, and as the vacuum falls a spark passes between the electrodes, but the spark ends on the edges of each electrode, just as would happen if the spark passed between two plates at ordinary atmospheric pressure.

Metallic-Impact or Focusing-Tubes.—For sciagraphic purposes or sharply defined shadows on a screen, the focusing-tube is now generally used, and for definition is superior. The general directions already noted will apply to both their manufacture and use. But they have added emphasis for this type, since some makers, from mistaken ideas, over-pump the tubes, so they regain an extremely high vacuum for excitation. Nothing is gained by this except liability to puncture, since such tubes can be made to work with perfect satisfaction on low excitation.

Historically the credit for the design of the usual type of focusing-tube does not belong to any particular person, since it originated simultaneously with a number of investigators, both in this country and in England. As ordinarily made, it contains a concave or focusing cathode and an impact-plate of platinum. They require about 10 hours to work them up to powerful action, and the vacuum heightens rapidly when in use. The writer has been able to prevent the latter fault, and obviate tedious "working up" by application of the above principles in a design shown in Fig. 2. In this the modification is merely the insertion of an aluminum disc anode. When a new tube is placed in circuit, the connections are made with the cathode and disc *B*. In an hour or two the fluorescence of the tube will show a greenish tinge indicative of the properly sustained vacuum. The anode connection is then changed to *D* and the tube will emit the ray with its maximum power. The latter connections are the proper ones for constant use. When the vacuum becomes too high a reversal will remedy it for a time. By connecting with the cathode and *B* disc and reversing the polarity the vacuum may be still further lowered. The functions of the disc *B* are to shorten time of "building up," and to lower the vacuum from time to time by reversal.

A very frequent error has been printed regarding the action of such tubes, to the effect that the maximum ray effect is normal to the impact plane. An examination with the fluoroscope will show that this is not correct; the maximum effect is in the plane of the platinum sheet. This statement holds true for the first type of tube as well. The maximum effect is always in the plane of the impact surface. This shows that the surfaces act by generation and not by reflection. The plane disc is probably not the best shape that can be given the impact surface; a truncated cone would no doubt prove superior, both for definition and intensity.

In the absence of demonstration the probability is that all Röntgen rays are not alike, and whether the wave form is transverse, longitudinal or resembles the circular polarization of light, there is doubtless among them a considerable range of frequency. Whatever be the type of tube, when new, and the ray is given off feebly, it has a very low penetrating power. This is true, but to a less extent, when the tube is afterward but feebly excited. The character of the impact surface also has a marked influence on the penetrating power of the ray. It is here assumed that the penetrating power is in some sense a function of wave-frequency.

Comparison of Types.—From present indication, both the glass and metal impact tubes are permanent types. Should the therapeutic action of the ray be established, the pear-shaped tube seems best adapted for such service. For examinations with the fluoroscope or the making of sciagraphs, when sharpness of detail is wanted, the focusing tube is of course superior. But there is a marked difference between the types, both in penetrating power and in effect on the fluorescent screen. With equal conditions of vacuum and excitation, the ray from the glass impact has the higher penetrating power, while that from metal impact produces the more brilliant illumination of the screen. Frequently when examining the body the rays from the former seem to have completely penetrated the body structures, so as to make them scarcely visible. This has never been noticed to the same extent with the other type. So far as rapidity for making sciagraphs is concerned, the writer has been able to obtain shorter exposures with this than have yet been noted with the other type. A glass surface is undoubtedly the best suited for generation of the ray, and were it not for its transparency, it would be well to make the impact plane of the focusing tube of this material provided it would withstand the intense heat.

Generation of Acetylene.

A French physicist, Chassevant, has found that by putting alcohol in the water, the generation of acetylene from the carbide may be regulated much better than by the use of water alone.

WILLOW GROVE PARK AND ELECTRIC ROAD.

BY HERMANN S. HERING.

I.—INTRODUCTORY.

FIG. 1.—PANORAMA OF WILLOW GROVE PARK.

1. New Welsh Road. 2. Freight Station. 3. Toboggan and Scenic Railway. 4. Athletic Field and Bicycle Track. 5. Grand Stand. 6. Shoot the Chutes. 7. Motor House. 8. Theatre. 9. Toboggan Incline and Shed. 10. Carrousel. 11. Lake and Pavilion. 12. Refreshment Pavilion No. 1. 13. Ladies' Lavatory. 14. Casino. 15. Bicycle Locker. 16. Music Grove. 17. Electric Fountain. 18. Music Pavilion. 19. Lake No. 3. 20. Superintendent's House. 21. Power House. 22. Water Tower. 23. Car Barn.

TRAFFIC on electric roads in sparsely settled suburban districts does not afford a large per cent. of paying load, if limited to the residents. The cost of operation per car mile varies but slightly with the number of passengers carried per car, while the earnings vary decidedly. Railway managers have therefore endeavored to increase traffic on such roads by offering inducements to visitors and pleasure seekers. In some cases roads are built to reach places of amusement already existing; in others the railway company or some of its stockholders build an amusement resort at the terminus of the road. The latter case is the more common, and one of the newest, handsomest and most successful of these resorts is herein described.

A few years ago, during the general installation of electric roads in Philadelphia, the People's Traction Company built an electric railway on the Old York Road to Willow Grove about 15 miles distant. Mineral Springs Park was located there and the road ran through a most beautiful and historic country, well settled, though not densely. Cars were operated on 10 and 15-minute headway and the traffic was good but light.

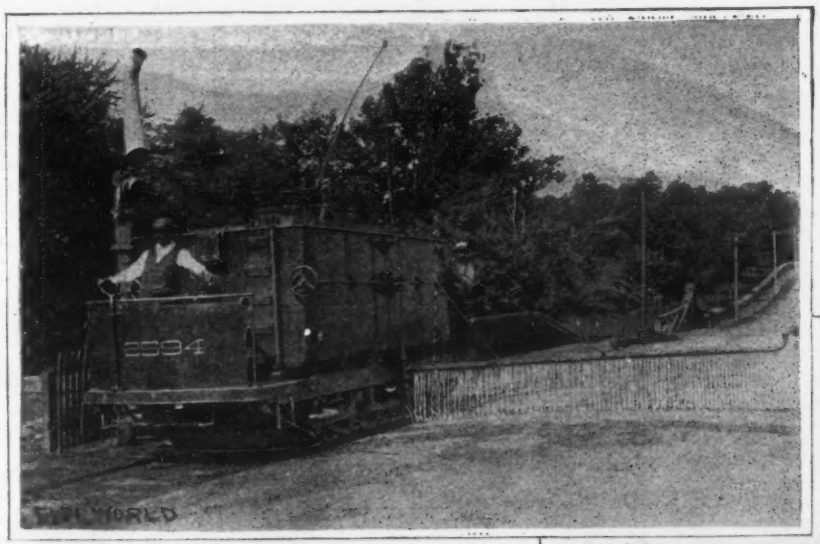


FIG. 2.—ELECTRIC CAR SPRINKLER.

Shortly after the consolidation of the three largest electric railway companies into the Union Traction Company, about a year ago, plans were made for constructing an amusement park at the Willow Grove terminus on a magnificent scale and of a first class order. The 105-acre tract of land procured was an old farm and contained woods, fields, meadows and swamps, which in the phenomenally short time of a few months was converted into what is probably the largest and handsomest park of its kind in the country. The outlay was about $400,000 for the park and terminal railway facilities.

Although this was considered a hazardous undertaking, it has proved to be most successful; far more so than was expected by the originators.

The park, including the concerts, electric fountain exhibitions, and all the conveniences are open to the public free of charge.

II.—LOCATION.

The location of Willow Grove Park is shown on the map, Fig. 4. The surrounding country, as well as that along the road from Philadelphia, is of a rolling character and exceptionally beautiful, containing many magnificent estates and residences. Fig. 5 is a view near Ogontz, and shows the general characteristics of the road.

The map also shows the general character of the electric roads, in and about Philadelphia. All the lines are given, though many extend beyond the limits of the map; the aggregate length of single track is about 670 miles, and the capacity of the power houses about 37,000 horse-power. Of this the Union Traction Company alone operates 518 miles of track, 21,600 car-hours, (1800 twelve-hour or 1200 eighteen-hour cars), and has a power house capacity of 30,000 horse-power, which makes it probably the largest electric railway company in the world.

The park is readily accessible from all parts of the city by means of through cars and transfers.

III.—CAR SERVICE.

The Union Traction Company runs a through car service on three of its lines, Fourth and Eighth Streets, Tenth and Eleventh Streets, and Thirteenth and Fifteenth Streets, the cars running out one street and back the other, all merging into the double track on the York Road after leaving the built-up portion of the city. These routes are shown in the map, Fig. 4.

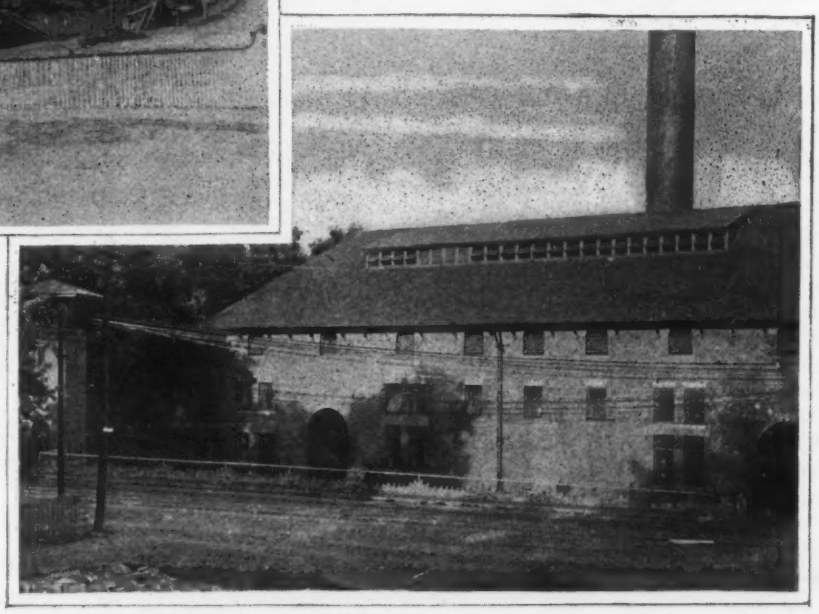


FIG. 3.—OGONTZ POWER HOUSE UNION TRACTION COMPANY.

All of the lines of this company crossing either of these routes issue transfers for eight cents, good to the city line, about eight miles

north of City Hall. From this point to Jenkintown, 2.8 miles, another fare is collected, and still another from Jenkintown to Willow Grove, 3.3 miles. The fare on any of these through cars is therefore 15 cents each way, and for other lines by means of transfers 18 cents. This averages about one cent per passenger-mile, and if the longest ride is taken, from Darby to Willow Grove, 22 miles, the fare being 18 cents, the cost is about eight tenths of a cent per passenger-mile.

The through cars on the Fourth & Eighth Street line run all day at a five-minute headway and the other two lines run on the same headway in the afternoon and evening, together making a headway on Old York Road of one and two thirds minutes. This makes 36 cars in use in the morning and 108 the rest of the day. Extra cars are often run, making the average 131 cars in operation at a headway of from 1 to 1½ minutes. Extras are run as the travel requires, and as high as 160 cars have been run for six hours, and all without a shut-down or delay. This is certainly excellent service for a suburban road of such length.

The length of the round trip is 31.6 miles, including the loops, and on an average day 600 trips are made, amounting to about 19,000 car-miles. The scheduled running time, not including lay-overs, is two hours 32 minutes, an average speed of about 12¼ miles per hour.

Summer cars with cross-seats and side-steps are mainly used, though some have a centre aisle with front and rear steps. They are all equipped with G. E.-800 motors.

The company has a large number of "trolley party" cars, handsomely decorated with lamps and hangings in various designs. These are used principally on this road, as it is the most popular. Several of these cars are equipped with as many as 800 lamps.

There are also double-truck "parlor" cars, handsomely furnished with chairs, the large panes of glass being removable, so that the cars can be used in Summer as well as in Winter. Freight cars for handling the supplies of the company, mail cars with complete railway post office equipment, electric car sprinklers, a bicycle car equipped with racks and used to carry bicycles from the Park after the concert, and a refrigerator car for carrying the supplies to the restaurant at the Park form part of the equipment.

IV.—ROADWAY.

The tracks follow the Old York Road, and are laid in the middle of the roadway in built-up portions of the city and towns, and along the sides the remainder of the way, leaving the middle free for a broad driveway. Fig. 7 is a view taken near Jenkintown and shows the general character of the road. The telephone cable is shown on the left and the feeder cables on the right.

The road is very hilly, with but few level stretches, and the heaviest grades are 6 per cent. and 8 per cent., the latter being at Ogontz.

The overhead work consists of side-pole, span-wire construction of the best character. The poles also carry the feeders and sundry small wires in addition to the telephone cable belonging to the private telephone system of the company.

The trackwork, except on paved streets, consists of 60-pound T-rails on heavy oak ties, laid in stone ballast. The rails are double-bonded and connected with the return feeder, which in the suburbs is strung overhead with the other feeders. In the paved streets 90-pound girder rails are used. The gauge is 5 feet 2¼ inches.

At the time the tracks were laid the road was regraded and macadamized, though following the general grade of the old road. The surface of the driveway is smooth, well drained and maintained in perfect condition, being cleaned and lightly sprinkled daily. This route is very popular for driving and bicycling.

The road is sprinkled by means of electric car sprinklers, one of which is shown in Fig. 2. The company runs them on all of its suburban roads, but this division requires the constant use of three. The tank capacity is 5000 gallons, which is sufficient for sprinkling five miles lightly. The sprinkling being light and frequent the road is never dusty or muddy. The perforated swinging arm on each side is operated from the rear by means of hand wheels, and levers control the water, which can be thrown on either side and in the centre, to accommodate any width or condition of road. These cars are also equipped with G. E.-800 motors. Fig. 9 is a view taken on the grade near Abington, showing the sprinkler at work. The dry and wet portions are easily distinguished. These cars run on passenger-car schedule.

V.—POWER HOUSE.

The main portion of the power operating the road is supplied by the power station at Ogontz, about one mile north of the city line. This station is equipped with three units, each being a 1200-hp vertical Allis compound condensing engine directly coupled to a Siemens & Halske generator, and has Berry boilers with natural draught. The equipment throughout is of the best, and architecturally the building is exceptionally fine.

Fig. 3 shows a front view, with the feeder tower on the left, by means of which the feeders are brought from the cable vaults. The location of the station is very picturesque, and the grounds are kept in perfect order.

This station feeds south to Germantown Avenue and north to the Welsh Road, within a half mile of Willow Grove Park, making about 9½ miles of double track. Four feeders run in each direction and two 500,000 circ. mil cables run to the Willow Grove Power

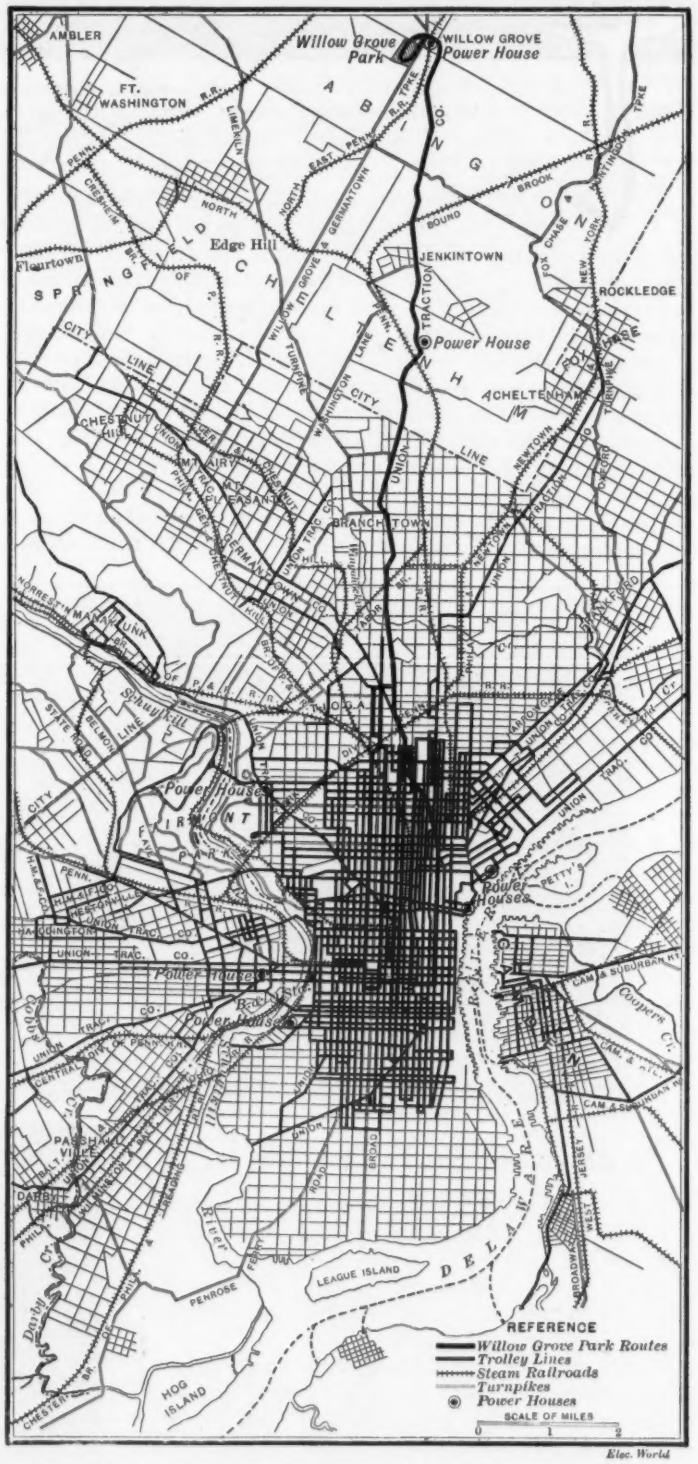


Fig. 4.—Map of Philadelphia and Vicinity, Showing Electric Railways.

House, so that during light duty the Willow Grove station can shut down.

The Willow Grove station supplies the power used at the Park and also takes care of the cars on the loop and as far as the Welsh Road one-half mile south. It contains one E. P. Allis, horizontal high-pressure engine, directly coupled to G. E. 10-pole, 300-kw generator making 80 revolutions; and three 250-hp Wetherill engines, making 80 revolutions, each belted to a Westinghouse four-pole generator mak-

ing 545 revolutions. These units were taken from the Sutherland Avenue station which was discarded after the consolidation. The generators are coupled to the common bus-bars from which the feeders run to the line and Park, but most of the Park feeders are connected to a separate bus-bar of their own.

In addition there are two pairs of motor-generators for supplying the Park with a 110-volt current. They each consist of a 50-hp 500-volt motor, 75 amperes, coupled to a 38-hp 110-volt generator of 260 ampere capacity. The 110-volt circuit in the Park is wired with the three-wire system, and in the evening these two generators are connected to it for 220 volts, but during the day the load being small only one of these motor-generators is run, and the three-wire changed to a two-wire system by connecting together the positive and negative leads, and making the neutral wire one of the mains.

Adequate and convenient switches are placed on the switchboard to control all the various circuits in the Park as well as the three feeders to the railway.

The boilers are Wetherill return tubular, six 125 horse-power and two 100 horse-power, the latter being new.

Water is obtained from an artesian well supplying a tank of 20,000 gallons capacity on a 60-foot tower.

This station will soon be equipped with a new generator, and the road extended to Hatboro, 2¼ miles north, after which it will feed south of the Park to Abington, 2 miles, and relieve the Ogontz station to that extent. At present both stations are frequently loaded to their maximum capacity.

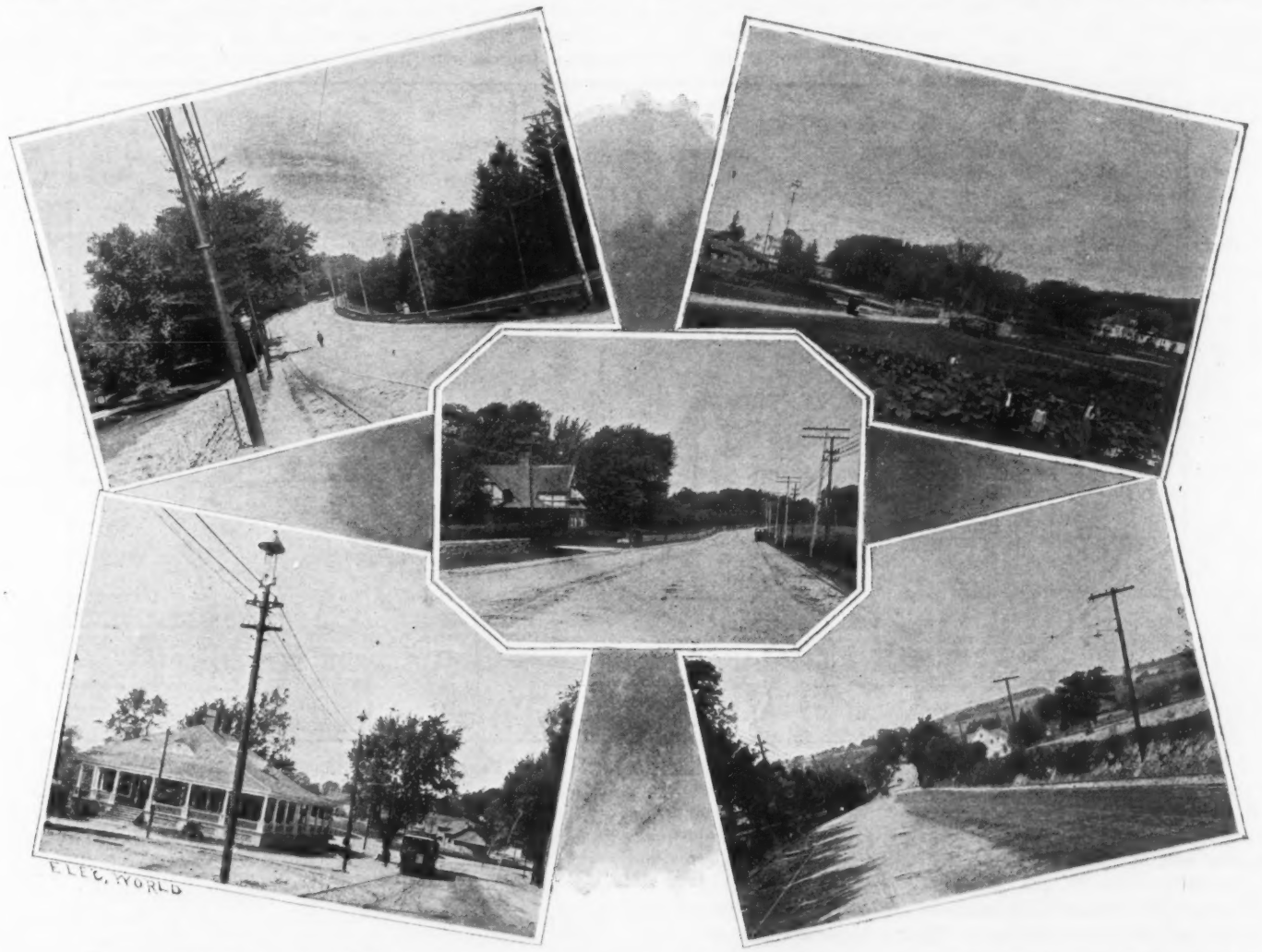


FIG. 5.—OLD YORK ROAD NEAR OGONTZ.

FIG. 6.—WAITING ROOM AND LODGE, WILLOW GROVE PARK.

FIG. 7.—OLD YORK ROAD NEAR JENKINTOWN.

FIG. 8.—WILLOW GROVE PARK, NEAR MAIN ENTRANCE.

FIG. 9.—OLD YORK ROAD.

VI.—GENERAL DESCRIPTION OF THE PARK.

The map shown in Fig. 10 gives the general plan of the Park, the location of the buildings, railway loop and feeder conduits. The area is 105 acres; its greatest length is 3600 feet, and greatest width 1400 feet, the average being about 1100 feet.

Fig. 1 gives a general view of the Park, the buildings and amusement structures of which are named underneath. This view is a very pretty one, with the light colored buildings dotted among the trees and lawns. At night the Park is aglow with electric lights of various kinds and colors. To the left of the Casino are the amusement features, and to the right the music, electric fountain and landscape garden features. The fountain can be seen in the view near the music pavilion.

The grounds are very beautifully laid out with winding crushed stone paths, flower beds and well-kept lawns, lagoons with aquatic plants, rough-cut brown granite bridges and drinking fountains, boat lakes and buildings of much architectural beauty, all combined with a taste and elegance rarely found in amusement enterprises of this character. The architecture of the buildings is Colonial and they are painted with a soft combination of yellow and white which is very pleasing and refined.

There are about seven acres of waterway, all the lakes being artificial though located in the bed of a creek.

The railway makes a loop just inside the border of the Park and numerous platforms are arranged as landings.

At the main entrance is the superintendent's office, a very picturesque rough-cut brownstone house one story high. Also the Waiting Room which contains, in addition to very handsomely furnished waiting apartments, the offices of the terminal station master and division superintendent, and the lunch room of the motormen and conductors. Fig. 6, looking toward the park entrance, shows the Waiting Room on the left and the superintendent's lodge on the right. Fig. 8 is a view of the north end of the Park near the main entrance and also shows the Lodge and Waiting Room with the lagoons and rustic bridge in the foreground.

Close by is the car barn which has a capacity of 235 cars; the repair shop, equipped with a pit, crane, etc.; a stone store house 36 x 40 feet containing a cemented lamp room, a slate and cemented water-closet for all the employees and a fireproof oil room; and a 20,000 gallon tank and a 60-foot stone tower supplied from an artesian well and furnishing water to these buildings as well as to the fire plugs and sprinkling cars. Farther west and just outside of the Park is the power-house, which has already been described.

The entire Park is provided with an abundant supply of pure

spring water under about 40 pounds pressure, from a stand pipe to which it is pumped by an electric motor. The water for the electric fountain is obtained from the lake.

The buildings and grounds are also provided with a perfect system of underground drainage.

The attendance has been from 5000 to 10,000 on ordinary days and from 25,000 to 50,000 on Sunday and special occasions. The Philadelphia & Reading Railroad handles some of this traffic and many visitors come in carriages and on bicycles.

A very good class of people patronize the Park and no instance of disorder has yet occurred.

VII.—THE ELECTRICAL EQUIPMENT.

The entire Park, including all the buildings, is lighted by electric lamps, and all the power, except the refrigerating plant in the Casino, is supplied by electric motors. There are in all 4300 16-cp lamps, 120 5-ampere series incandescent lamps, and 110 arc lamps; the power of the various motors aggregates 226 horse-power. The grounds and exteriors of the buildings are beautifully lighted, and the effect is a very brilliant one at night. The borders of two of the lakes and many of the structures are outlined with lamps of various colors, as well as the porches and eaves of the buildings.

VIII.—ARC LIGHTS.

There are 110 arc lamps used in and about the grounds, and 15 Rushmore focusing lamps under the fountain. Ten of these are G. E. lamps and are located at the main entrance. The remaining 100 are Helios lamps, 45 volts, 12 amperes, 2000 rated candle-power. All these 110 arc lamps are connected 10 in series and run on the 500-volt circuit.

There are nine ornamental iron towers, 40 feet high, about the grounds, each holding five lamps. Two of these are shown in Fig. 8. Back of the lamps are curved surfaces painted white, which, together with the globes, make a very good effect. In addition to these there are five single lamps on poles, which with the towers are located on the map, Fig. 10.

There are 10 arc lamps on and about the Shoot the Chutes, 20 around the bicycle track, supported on swinging arms; 20 are placed on the railway loop bordering the Park, and 10 near the main entrance. These 110 lamps have 11 feeders running to the switch-board in the power-house. The wires for the towers and single lamps are run through the conduits, but those for the others run along the railway poles.

IX.—INCANDESCENT LIGHTS.

The lights in the Casino, Music Pavilion, Ladies' Lavatory and Theatre, aggregating over 1200, are 110-volt lamps run on the three-wire system.

Around the two largest lakes are 120 five-ampere, 25-volt Heisler series incandescent lamps, arranged in clusters of two in a large glass globe placed on an ornamental eight-foot wooden post. The lamps are connected 20 in series on the 500-volt circuit.

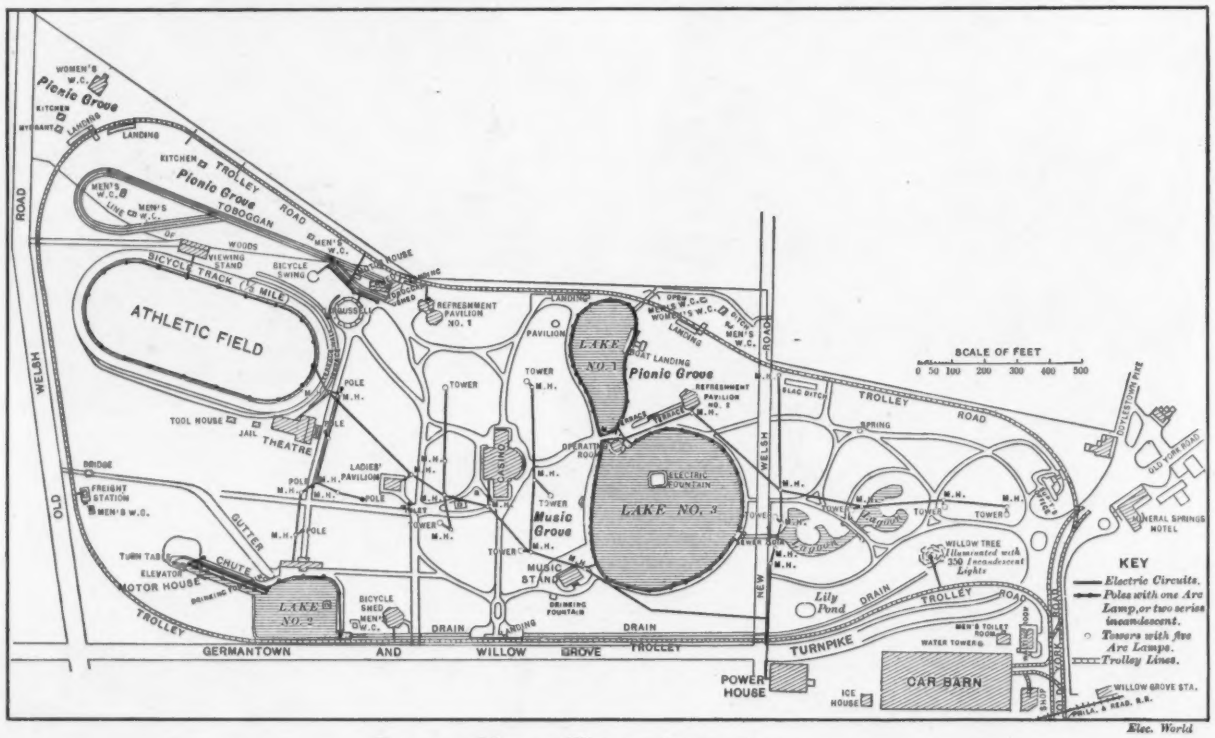
The balance of the lights are 100-volt lamps, run five in series on the 500-volt circuit, either on one of the feeders in the conduits or those on the railway poles.

The Casino has 582 lamps in all. The large dining hall has a 50-light chandelier and 28 three-light clusters on the ceiling arranged with spring connections so that they can be lowered for renewals. The semi-circular veranda has 11 four-light clusters with dome glasses, and the two large porches each have one seven-light and four five-light chandeliers. The eaves have 150 lights and the general effect is brilliant. The kitchen and sundry rooms have 200 lights. There are seven distribution points and all of the wiring is concealed.

The Music Pavilion has 260 lights; 101 are placed inside of the proscenium arch, and illuminate the band without being visible to the audience. There are 20 lamps of various colors placed on the tips of the numerous flag-staffs on the flat roof of the building, and the remainder are in the various rooms.

The refreshment pavilions have some lights on top and on the eaves, but most of them are on the inside. In addition to the arc lamps the Shoot the Chutes has 120 incandescent lamps, purely for decorative purposes, running along the incline and the tower.

One of the attractive novelties is the large willow tree, near the main entrance, wired with 350 incandescent lamps of various colors, making a good effect. The lamps in waterproof sockets are strung in fives from one branch to another, and run on the 500-volt circuit.



Elec. World

Fig. 10.—Map of Willow Grove Park.

TABLE I.

Summary of Incandescent Lamps.*

110-Volt Lamps, 3-wire System.		
Music pavilion	260	
Casino	582	
Theatre	320	
Ladies' lavatory	75	1237
100-volt Lamps, 500-volt Circuit.		
Refreshment pavilion, No. 1	185	
Refreshment pavilion, No. 2	110	
Bicycle grand stand	400	
Carrousel	375	
Shoot the Chutes	120	
Toboggan	125	
Willow tree	350	
Lake pavilion	110	
Bicycle locker	100	
Superintendent's home	50	
Fountain operating room	50	
Bicycle swing	50	
Freight station	20	
Water closets (9)	45	2090
Entrance to Grounds and Railway Terminus.		
Waiting room	130	
Car shed	500	
Power house	220	
Store house	30	
Employees' house	75	
Stable	20	975
		4302

* Series incandescent lamps omitted.

X.—MOTORS.

The largest motors are the two 75-hp G. E.-2000 railway motors used to run the fountain pumps. These are in the operating room under the lake pavillion, and will be referred to later on.

In this room is also a 5-hp G. E. 500-volt motor, making 1000 revolutions per minute, geared to a 5 x 8 triplex Dean pump, making 40 strokes and pumping 80 gallons per minute. This pump is used to pump water from the springs to the stand pipe, one-quarter mile distant, which furnishes the water supply for the buildings and grounds.

The power plant of the Shoot the Chutes, 25 feet square, consists of two 20-hp G. E. four-pole 500-volt motors, running at 600 revolutions per minute. One operates the inclined approach that hauls the cars from the water to the base of the elevators by means of a link belt conveyor. The other motor drives a 8½ x 8 triplex Deming pump working the two hydraulic elevators.

The Carrousel plant consists of a 5-hp G. E. 4-pole 500-volt motor running at a speed of 1000 revolutions per minute and belted to the revolving mechanism and also to the organ.

The Toboggan plant has a 20-hp G. E. 4-pole 500-volt motor running at a speed of 650 revolutions per minute and driving the link belt mechanism that hauls the cars along the incline to the top of the structure, 75 feet high. A safety switch is placed at the landing platform to shut off the current quickly in case of accident.

The Casino has a 4 x 5 Albro Clem 1000-pound freight elevator from the kitchen to the ground floor driven through a fast and loose pulley by a 6-hp Lundell motor on the 500-volt circuit.

TABLE II.
SUMMARY OF EQUIPMENT.

Motors.		H. P.	
Fountain Pump		150	
Shoot the Chutes		40	
Carrousel, Toboggan and Casino		31	
Water Suppy Pump		5	
			—226
Arc Lamps.			
11 Circuits of Lamps		88	
Fountain Lamps		80	
			—168
Series Incandescent.			
120 Lamps—6 series of 20		20	
			—20
Incandescent.	No.		
110-Volt Circuit	1237	82.5	
500-Volt Circuit on grounds	2090	139.5	
500-Volt Railway Terminus	975	65.0	287
	4302		701

TABLE III.
USUAL OPERATION.
Power House Readings.

Fountain Pump	125 amp.,	500	volts	83.8	
Other Motors	75 "	"	"	50.3	
11 Circuits of Arc Lamps	129 "	"	"	86.5	
Fountain Arc Lamps	120 "	"	"	80.5	
Incandescent Circuits	170 "	"	"	114.0	
" "	(no ammeter, approximated.)			61.0	
" "	450 amp.,	110	volts	66.4	
					—542.5

Operation 77 per cent. of the capacity; sometimes runs to 600 horse-power making 86 per cent.

XI.—CIRCUITS.

All the circuits through the grounds are run in conduits, but some of the feeders are strung along the poles of the railway loop and run into the buildings through ducts, or, in a few cases, directly overhead.

The conduits are the Wyckoff pattern, made up of creosoted wooden "pump log" ducts, with square sides and 3-inch bore. The line of these conduits is shown in the map of the grounds, Fig. 7.

The conduit leaving the power-house has 16 ducts and 21 feeders. Brick manholes and junction boxes are placed at frequent intervals, facilitating repairs, alterations and additions.

The lead-covered cable of the Safety Insulated Wire & Cable Company, of New York, is used in all the underground work, No. 8 B. & S. for the arc light circuits, and 250,000 to 500,000 circ. mil cables for the incandescent and motor feeders.

About 1982 incandescent lamps are supplied through the conduits, 1345 in the Park from the overhead feeders, and 975 in the buildings connected with the railway terminus.

The electric motors of the toboggan, carrousel and Shoot the Chutes are run from extra feeders strung on the railway poles and are grounded on the railway return circuit, which consists of a return wire in addition to the rails. The motors driving the fountain pump, water supply pump, and electric freight elevator in the Casino are run from underground feeders.

The principal circuits to the large buildings and the motor circuits are controlled at the power-house switchboard by individual switches, and fuses, secondary switches and sundry distribution switches are placed throughout the grounds and buildings in convenient places. These feeders are as follows:

11 to arc light circuits.
1 to fountain lamp.
1 to lake border lamp.
3 to three-wire system.
2 to bicycle track.
1 to Shoot the Chute motors.
1 to toboggan and carrousel motors.
1 to fountain motor.
4 return cables.

In addition to these there is also a telephone cable connecting the important buildings.

(To be continued.)

Street Railway Traffic In New York City.

Few of the thousands of persons who ride on the modern, well furnished trolley car, are aware, or realize the fact that the practical electric railway is not yet 10 years old, and will not be until February, 1898. The rapid development of this great industry furnishes one of the most interesting facts in the industrial history of the world, and much credit is due to Mr. Frank J. Sprague for his persistance in bringing to a successful issue the installation of the first practical electric railway, in February, 1888. Prior to that time the street railway business had been of comparatively slow growth from the time of its inception, in 1832, when the fantastic omnibus car *John Mason* made its first trip over scrap rails through Fourth Avenue, in New York City.

The history of the street-car business, from the beginning to the present time, is an interesting one, but the chapter devoted to the application of electric power for the propulsion of cars presents a story of marvelous progress and industry. In every city in the land the street-car business has undergone a radical change by the substitution of electric for animal power, and in most all instances prosperity has followed these changes.

Street-car travel has greatly increased in all by reason of the better facilities offered by the electric system, in the way of more comfortable cars and quicker transit.

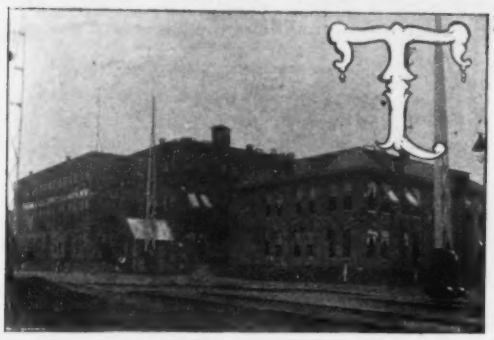
At the recent Street Railway Convention at Binghamton, N. Y., President Rogers referred to the remarkable growth of traffic in New York City, and presented some astonishing figures, and it is reasonable to assume that other cities have enjoyed like prosperity in a corresponding degree.

There is, however, this difference between the existing conditions in New York City and those in most all other cities, which should be borne in mind when making comparisons. In New York City the electric railway lines constitute a very small fraction indeed of the total length of street-car lines, whereas, in most all other places the electric system predominates, or entirely occupies the field. In New York City the elevated railway system plays an important part in the street transportation problem, and the cable lines afford some relief for the great traffic. These improved, though inadequate facilities, have brought about an enormous increase in travel, as may be appreciated from the figures presented by Mr. Rogers. In 1865 there were 11 street-car lines in New York City, in which year the total number of passengers carried was 79,618,818. In 1875 the Third and Ninth Avenue elevated lines were opened, increasing the number of lines to 13 and the number of passengers transported to 140,582,793. In 1878 the Sixth Avenue and the Second Avenue elevated lines were opened, and with these additional facilities 169,105,739 persons were transported. In 1883 the number of persons carried was 266,164,236, and in 1893, 453,652,964. During the decade last named the cable lines were built, which of course carried a large part of this enormous traffic. In 1893 the elevated railways alone carried 219,621,017 persons, the surface lines carrying 234,031,947.

Röntgen-Ray Hypotheses.

In an attempt to sum up existing Röntgen-ray hypotheses the London *Electrical Review* incorrectly states that the jet theory seems to be most in favor in America, and quotes extensively from Mr. Tesla's contributions as a substantiation for the statement. Until thus informed we were under the impression that there were other American investigators in this field.

Electrical Apparatus of the Fort Wayne Electric Corporation.



THE Fort Wayne Electric Corporation is one of the few prominent independent companies now manufacturing electrical apparatus. The office and works of this company are located in Fort Wayne, Ind., on the Pittsburg division of the Pennsylvania Railroad. The company is ably officered by Mr. R. T. McDonald, president, who has been from first to last active in its affairs. He is one of the incorporators of the original Fort Wayne-Jenney Electric Company; Mr. C. S. Knight, vice-president, is an old railroad man and was induced to unite his interests with the Fort Wayne Electric Corporation by Mr. McDonald; Mr. Charles C. Miller, secretary and treasurer, is a native of Fort Wayne and has been in the employ of the company since its organization; the electrician and general superintendent is Mr. James J. Wood, who is well known in electrical circles. Mr. Wood is an Eastern man, having lived for a number of years in Brooklyn, N. Y. Since the earliest days of arc lighting his apparatus has been an active competitor in this field. Mr. F. S. Hunting began his career with this company in 1888, then acting as draughtsman. He is a graduate of the Worcester Polytechnic Institute, Worcester, Mass., and is now chief of the engineering department.

The productions of the Fort Wayne Electric Corporation include dynamos, motors and transformers for constant-potential, series-arc and alternating single-phase service. The various kinds of apparatus which it turns out are the design of Mr. Wood and are appropriately designated under the term "Wood System." It has practically superseded all of the apparatus hitherto manufactured by the company or any of its predecessors, although, as will be remembered, these older products have performed, and still are doing in many places, excellent service.

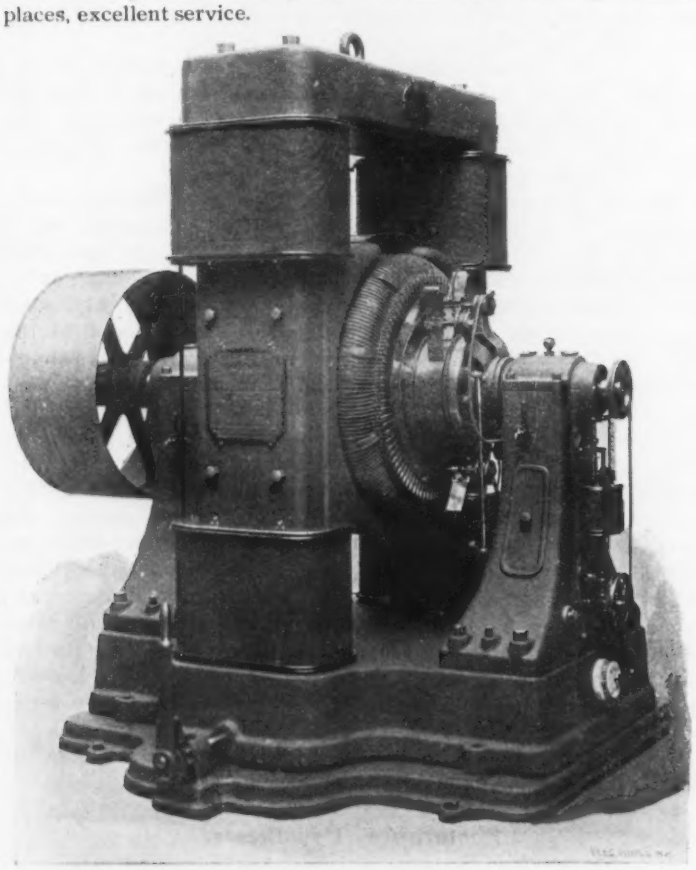


Fig. 1.—Arc Dynamo for 125 2000-cp Lights.

The arc-lighting system includes dynamos of the familiar type shown in Fig. 1. This machine has been manufactured by two companies in whose employ Mr. Wood has been. He has carried it with him and by improving it from time to time it is now, as manufactured by the Fort Wayne Electric Corporation, one of the few surviving arc machines which has retained its popularity. The machine shown in Fig. 2 is an 80-lighter and may be safely said to

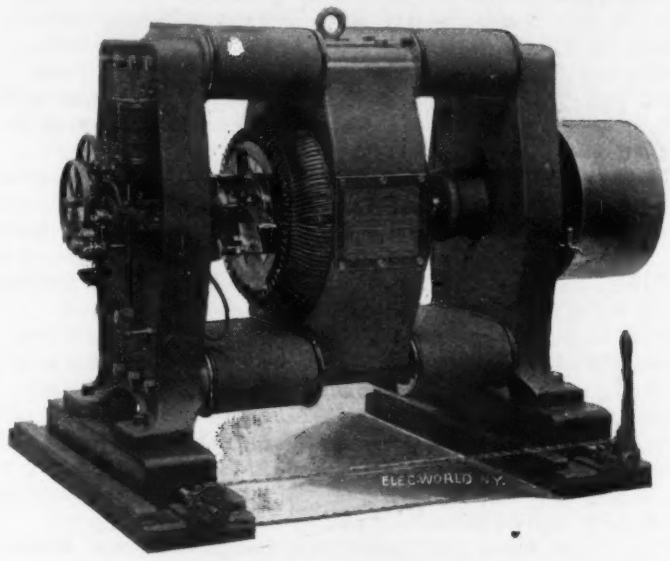


Fig. 2.—80-Light Arc Dynamo.

be the smallest and lightest machine of this capacity on the market. The pole-pieces and yokes are of cast iron while the magnet waists are of wrought iron. The magnetic circuit is quite long and is worked to an intense degree of saturation, so that the armature will react heavily upon the field and produce the desirable drooping

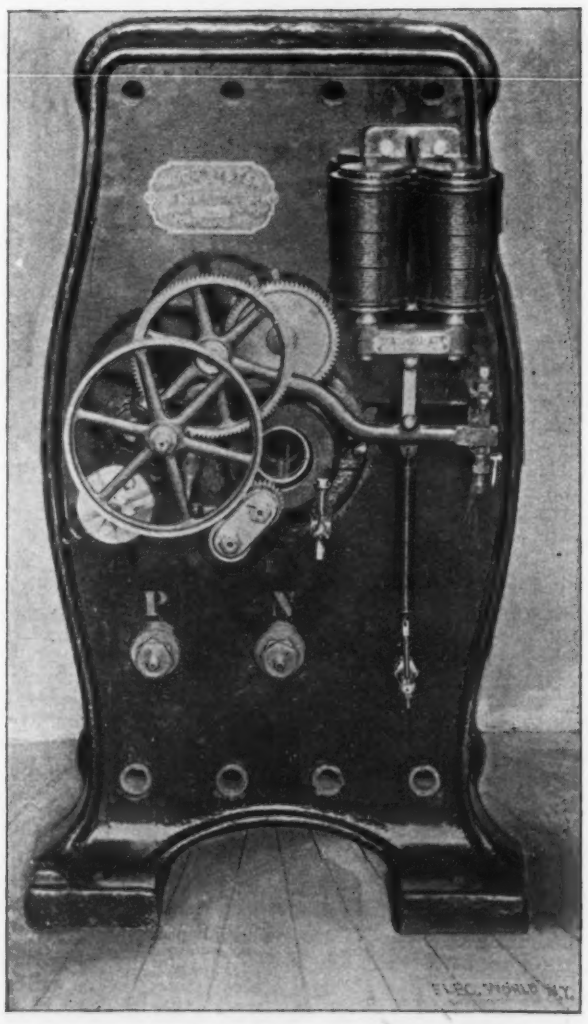


Fig. 3.—End View of Automatic Regulator.

characteristic which is an attribute of every good arc machine. The armature is a Gramme ring heavily overwound with wire connected to a commutator of many seg-

ments. The commutator is exceedingly well built and insulated with pure mica, the insulation between the segments being fully one sixteenth of an inch in thickness. The regulation of the machine is accomplished by the shifting of two brushes on the diameter of commutation. There are two positive and two negative brushes which are electrically connected with each other by a flexible conductor. Each pair is mounted on a separate yoke so that one can be moved independently of the other. The yokes are driven by the regulating mechanism, which will be described later on, and move together over the commutator but at different velocities. By this means more or less turns of the armature conductors are short-circuited between the two brushes, thus reducing the voltage and maintaining the current a constant quality. The throwing off of 25 lamps at a time does not move the ammeter needle more than a few tenths of an ampere, and this for but an instant, as it almost immediately returns to its original position, indicating 9.6 amperes.

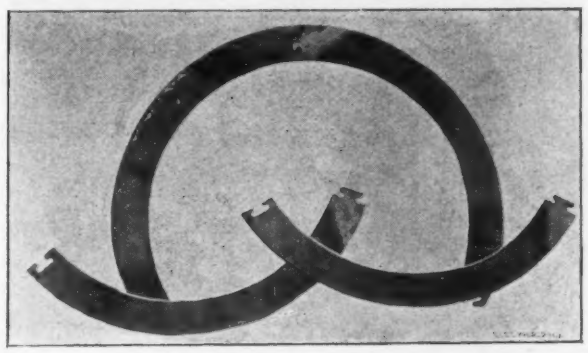


FIG. 4.—ARMATURE LAMINATIONS OF ARC MACHINE.

The regulating mechanism consists of a pair of rollers which are driven in opposite directions by a small pinion fastened to the end of the armature shaft. A lever presses either one or the other of these rollers, as the case may be, against a friction wheel, so that through a train of gears the brushes are moved. There are two separate pinions driving the brushes, one of which has a greater number of teeth than the other. This causes the difference in velocity of movement of the two yokes just referred to.

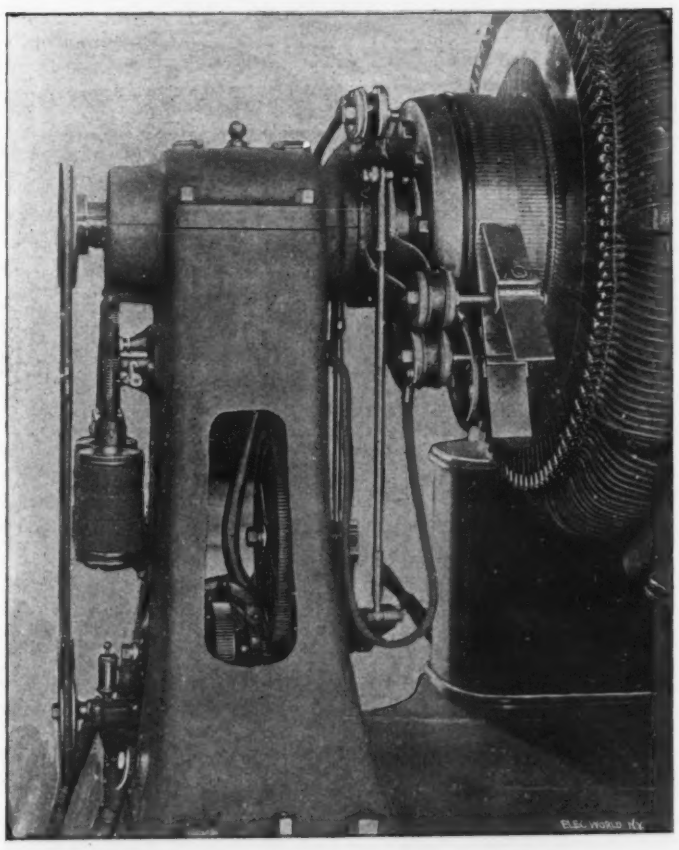


FIG. 5.—SIDE VIEW OF AUTOMATIC REGULATOR.

The actuating lever of the mechanism is controlled by an electromagnet of the solenoid type. This magnet is wound, as may be seen in the diagram, so that there are more coils of wire at the base than at the end, thus concentrating the magnetic field at the base, which has the effect of producing a long and steady pull. The magnet cores are slotted so as to avoid the lagging effect of eddy currents and make them respond quickly to current variations. At the same time small wheels are pivoted to the core so that it slides within the tube of the solenoid with a minimum amount of friction. A fan governor prevents sudden motions of the regulator. This type of regulator has been in use for several years and has always given very satisfactory service, but has been subjected to recent improvements and is, if possible, better than ever before and certainly more durable and less liable to get out of order. A view of the regulator and also of the self-aligning box is shown in Fig. 3.

The bearing is of the expansible type and so constructed that in case of heating it will not bind tightly on the shaft as has been shown in cases where the bearings become dry.

The latest production in arc-lighting machinery of Mr. Wood's design is a 125-lighter. The Fort Wayne people were among the first to produce a machine of this capacity which until only within the last few years has been looked upon as almost an impossibility, owing to the excessive voltage which it would produce. This machine possesses all of the features of the other just described and at the same time combines several new and important ones. The magnetic circuit is probably the most massive ever put into an arc machine. The pole shoes and the yokes are of cast iron, while the magnet waists are massive wrought-iron forgings. In order to economize floor space the machine has been made of the vertical type. It is provided with self-oiling bearings and is thoroughly modern in every detail.

The armature construction similar to that of the 80-lighter consists of a number of thin laminations bunched together, the shape of which is well shown in Fig. 4. Small dove-tailed notches in the ends join the segments together, the joints being staggered as the armature is built up. This forms a smooth body ring which is insulated and wound to a considerable depth with armature wire. The armature winding is done entirely by hand by means of a shuttle such as shown in Fig. 8. The core is strapped to a small bench and each coil is wound on and insulated from its neighbor and from the spider arms by liberal thicknesses of fullerboard and mica. When finished and varnished it forms a very neat piece of winding. The ends of the coils are connected by means of screw connectors to the commutator lugs in the manner shown in Fig. 5.

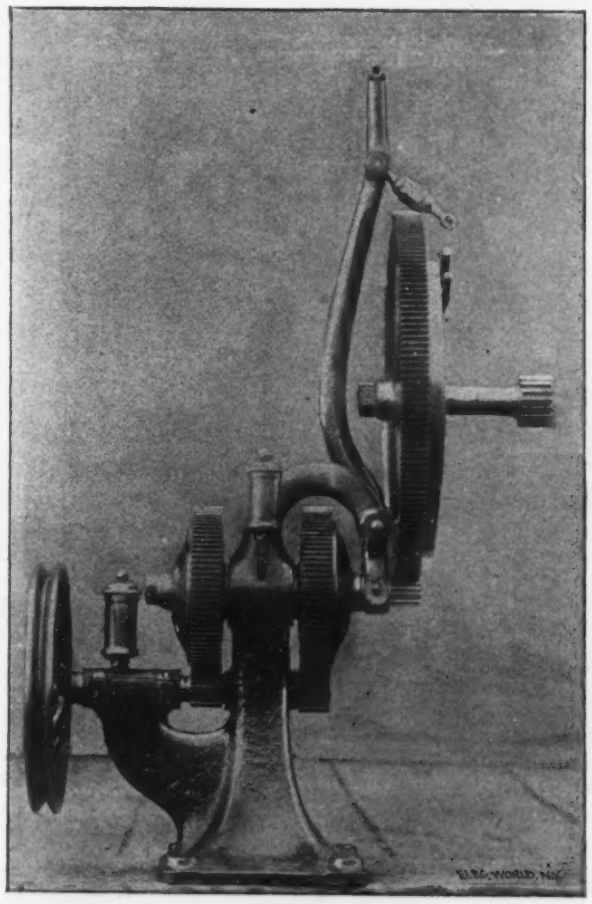


FIG. 6.—GEARING OF AUTOMATIC REGULATOR.

Among the chief features of the 125-light machine is its regulator.

The principle of the old regulator is retained, but it has been changed so as to adapt it to this machine, resulting in a superior construction from a mechanical standpoint and in no way inferior from the electrical. The long lever which is shown in Fig. 6 shifts a friction clutch from side to side, causing it to engage with one or the other of the small gear wheels just above the axle of the grooved pulley. These friction clutches are remarkably powerful, and the slightest touch of the lever suffices to operate them. The gear wheels are driven in opposite directions by suitable gearing, driven from the shaft, rotated by the grooved pulley. The clutches which engage with the gear wheels drive a pinion, which in turn drives a gear shown in the upper part of the figure. This gear drives an axle on which is a stop limiting its motion, and also a pinion which drives a segment connected through levers to the brush yokes. This lever and latch are shown in Fig. 8, which is a diagrammatic view of the regulator. The difference in the velocities is ingeniously obtained by placing one of the links in a slot on the lever, so that its range may be adjusted. As there are two slots, one on either side of the lever, it is possible within a few moments to alter the regulator for running the machine in the opposite direction. As will be seen from Fig. 7, and also Fig. 5, the regulating mechanism is placed within a pedestal on the commutator end of the armature. It is therefore well protected from dust, dirt or other interference. So powerful is this regulating mechanism that the shifting arm could easily lift a man's weight and at the same time properly adjust the brushes. A magnet similar to the one previously described having a core balanced by springs operates the regulator. These springs are suspended from either end of a small rocking arm so that their pull is equalized. The small catch shown just above the armature of the magnet serves to lock the mechanism so that the regulator does not act when the machine is running on overload, but if from any cause the armature should become short-circuited and an excessive current be called for, the magnet would itself unlatch this catch and throw the regulator into play, thus rapidly reducing the current to its normal value. The regulator is suitably lubricated by grease cups and no mechanical refinement is spared to make it a perfect device. As will be see in Fig. 5, the commutator is turned so that the brush surface is on a broad ridge at the outer end of the commutator, thus preventing any tendency to arc between the brushes and the adjacent commutator connections.

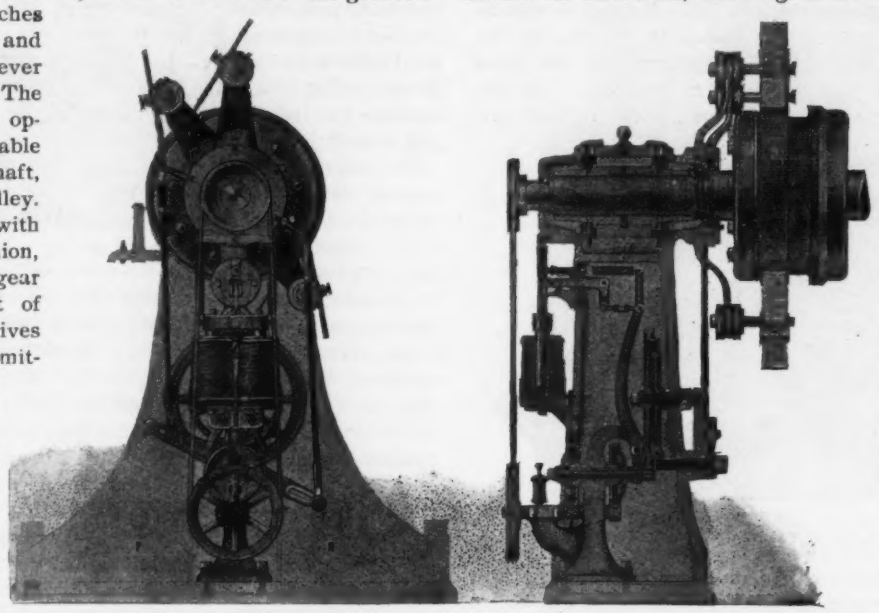


Fig. 7.—Details of Automatic Regulator.

In Fig. 5 it will be noted that the cap to the commutator bearing can be removed without altering or removing the brush holders, an important advantage. The insulation of this machine is the very best. With machines of such high potential it has always been considered injudicious to connect any part of the circuit with the frame of the machine, but so excellent is the insulation of the Wood machine that this may be done with impunity; in fact, the insulation is teased to break down, but it has never been known to accept the invitation. Of course, it is not regular practice to do this, but it is a frequent exhibition accorded to those who are examining the merits

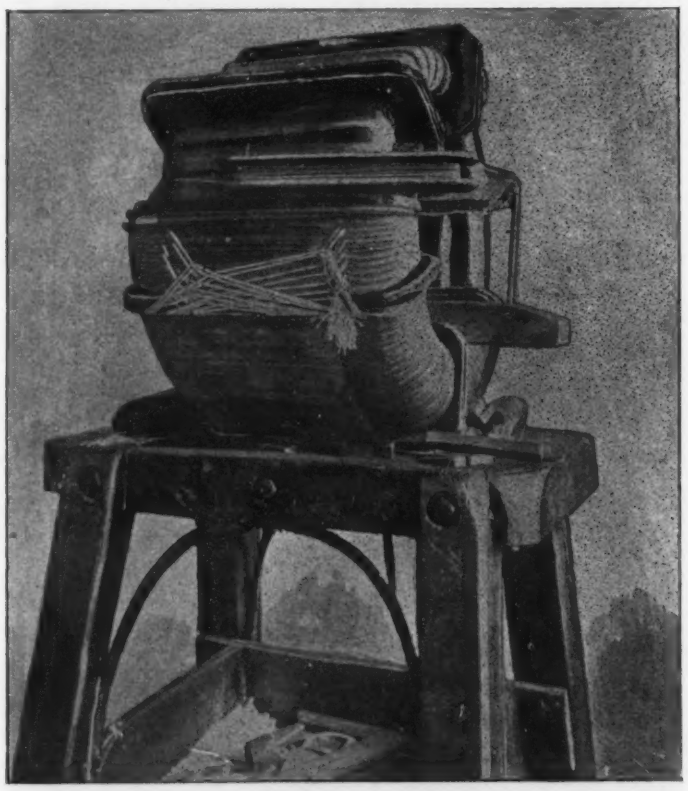


Fig. 8.—Winding Large Arc Armature.

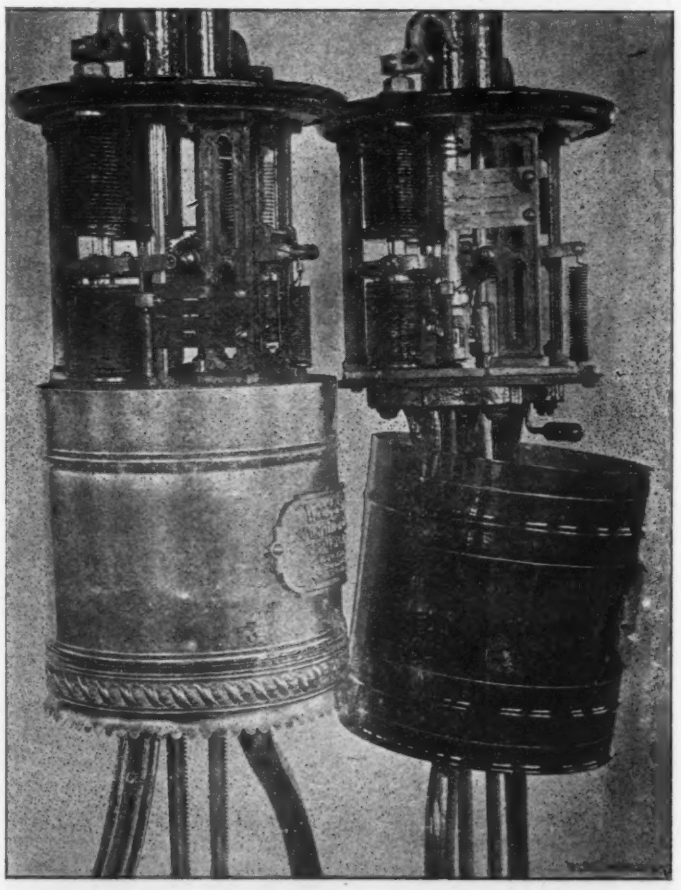


Fig. 9.—Arc Lamps.

of the machine. Another and even more striking example of the excellence of the insulation is the fact that the machine can be open-circuited on full load without injury, although one terminal is at the same time connected to the machine. The writer while at the works had an opportunity to photograph one of the arcs which was formed by thus breaking circuit. This arc is shown in Fig. 10: 150 lights were placed upon the machine, and at a given moment the circuit was broken. A five-foot arc followed,

FIG. 10.—7500 VOLT DIRECT-CURRENT ARC.

and the unique picture just referred to was the result of the instantaneous photograph, and when it is realized that several amperes are flowing at 7500 volts in this vaporous trail of flame, there is something in the picture which causes us to wonder whether this is not electricity that we see, after all. An arc of this kind will readily ignite a piece of wood, and yet scarcely affects the terminals from which it issues, a fact which makes it seem almost impossible that it can be luminous matter, resulting from the deflagrated terminals.

The 125-light machine is said to have an efficiency of 90 per cent., a very high figure for arc machines, and one rivaling some of the best in constant-potential practice. The rise in temperature is 40 degrees C. By removing the rear pedestal the armature can be removed in 12 minutes without disturbing anything else. The

FIG. 11.—LAMINATED POLE-PIECE.

fields are short-circuited when necessary by a small snap switch mounted on a marble base. The action of this switch is so quick that even with such highly inductive fields as this machine has, the arcing is but slight.

The arc machines just described operate arc lamps of the Wood type, although other lamps can be operated on the same circuits. Realizing the fact that popular preference is divided between the ear and clutch feed, Mr. Wood has designed both types of lamps. The gear feed is most suitable for indoor work, and the clutch feed for outdoor service. The mechanisms of the two lamps are shown in Fig. 9. It will be noted that with the exception of the gear and clutch arrangement, the lamps are otherwise very similar. They are double-carbon lamps, but instead of operating as does the Brush lamp, by lifting one carbon a little before the other, only one carbon operates until it has fed completely away, and the rod descends thereby throwing a small catch which starts the mechanism of its neighbor. The magnet armature now has to lift both rods and the weight of the carbon that has been consumed is thus compensated for. The adjustments of the lamp are very simple. The series and shunt coils are wound on two separate spools so that any damage to the one in no wise impairs the efficiency of the other, and, moreover, they are very easy to repair. The lamps are provided with hand and automatic cut-outs, have but one point of adjustment to regulate the arc and are fitted with adjustable globe and carbon holders which facilitate trimming. Besides the several styles of arc lamps, the Fort Wayne Company manufactures a focusing lamp and also one to be used in a headlight.

Next in order among the Fort Wayne products is its alternating-

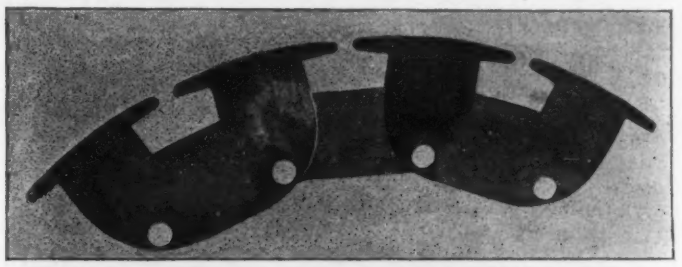


FIG. 12.—ALTERNATOR ARMATURE PUNCHINGS.

current machinery, and in this department as in the arc department its machines are distinctly different from other makes and show points of marked superiority in many respects. The Wood alterna-

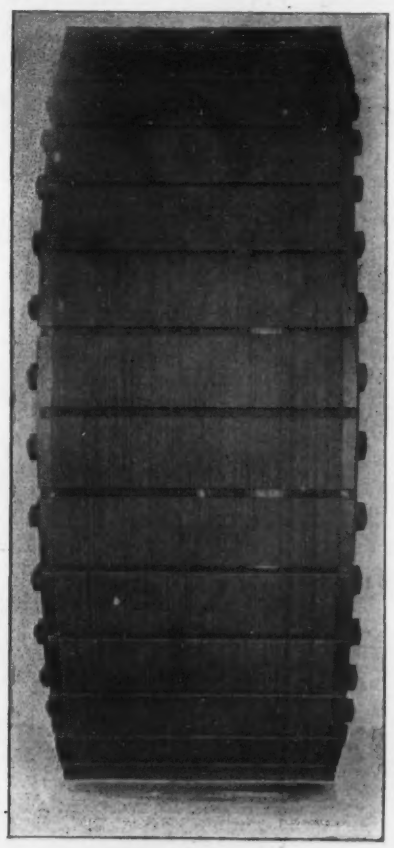


FIG. 13.—SHOWING VENTILATION APERTURES.

tor is of the most ingenious design, many of its good features, however, failing to show upon a casual examination, and in fact would not appear unless the methods of manufacture were rigidly inspected. In casting the field-magnets of large alternators it has been custom-

ary to cast the wrought-iron pole-pieces into cast-iron yokes. This process tends to weaken the yoke, especially when there are a large number of pole-pieces, for, in such an event, the magnetic circuits

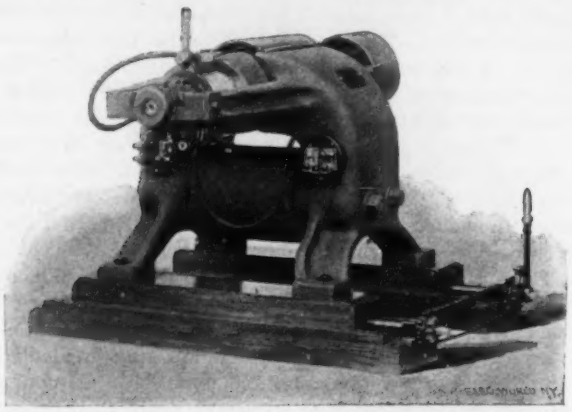


Fig. 14.—Motor, Generator or Exciter.

are very much smaller in cross-section and the large yoke piece has no greater cross-section than that of any individual magnetic-circuit. For this reason many manufacturers, although recognizing and admitting the excellent regulating properties of cast iron and

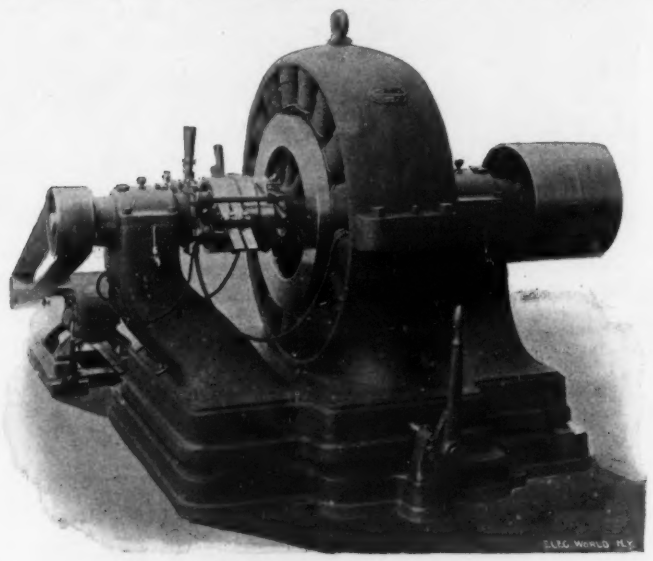


Fig. 15.—1500-Light Ironclad Compound-Wound Alternator.

wrought iron, have abandoned their use for steel, a material which is apt to be of a variable and uncertain quality. While very successful with steel frames, Mr. Wood is inclined to prefer those of

of pole-piece is shown in Fig. 11. It will be noted that it is made up of a series of identical punchings, each of which is cut off diagonally and notched on this opposite side in ths usual manner. Assembling these alternately as shown, the pole-piece is complete. These pole-pieces are cast into the field-frame, and the webs of iron which ziz-zag through the base of the pole-piece give the frame ample

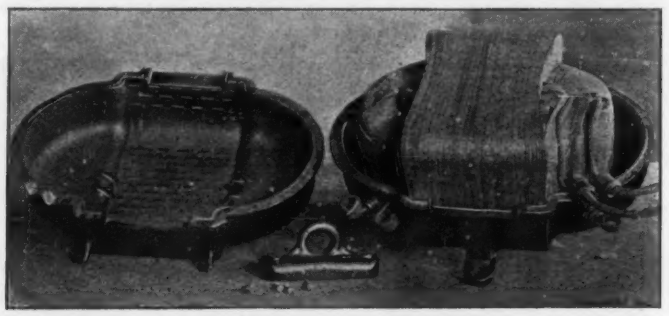


Fig. 17.—Transformer Open.

mechanical strength, while the large area of contact at the same time gives an excellent magnetic joint, so that the reluctance is not materially increased.

The armature also possesses some very ingenious features of construction. Chief among these is its ventilation, which, it is claimed, and apparently with ample foundation, is not surpassed by any machine in the market. In Fig. 13 is shown one of the alternator armatures ready to receive its insulation and winding. In photo-

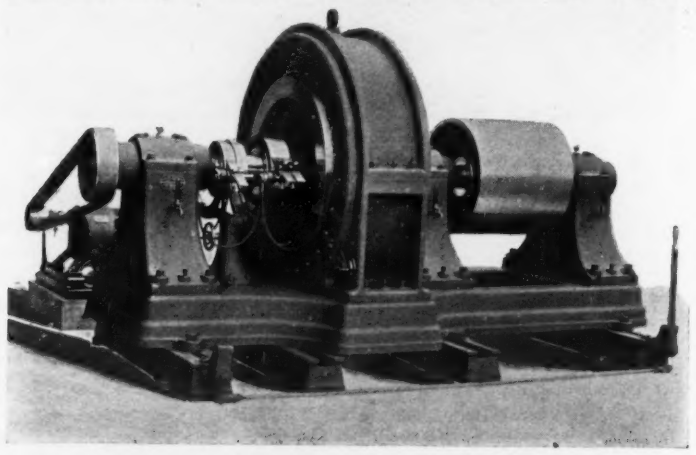


Fig. 18.—3000-Light Ironclad Alternator.

graphing this armature, the writer hung an arc lamp in its interior, the light of which shone through between the laminations under the conductor slots. It will be seen that only in a few places does this

Fig. 16.—Transformers.

cast iron with laminated poles, and in order to produce a machine that is sufficiently strong, mechanically, he has adopted the following ingenious improvement in forming the pole-pieces. This type

illumination show, but when it is remembered that these slots are some two or three inches in depth, the necessity of exact parallelism with the arc and other illuminated surfaces is apparent, so that unless

the eye is placed directly in line with the slots and source of light, the latter will not be noticeable. The cut suffices to show that the base of the armature is fairly honey-combed with ventilating holes, there being a ventilating slot for every lamination ; but if the grooves were filled up with conductors, these slots would be completely covered up, if it were not for the following ingenious device: The punchings for the armature which are shown in Fig. 12 are so made that one tooth is larger than the other; thus when they are assembled together there is a little groove which completely surrounds the coil and permits the air from the slot to flow up around the conductor and out. With such a multitude of little streams of air surrounding each coil, it is difficult to see how it can overheat. Fig. 12 shows how the slot in the base of the coil groove is accomplished, and also shows how the punchings are mounted upon the driving arms by means of bolts passing through the lower parts. This method, while cheap,

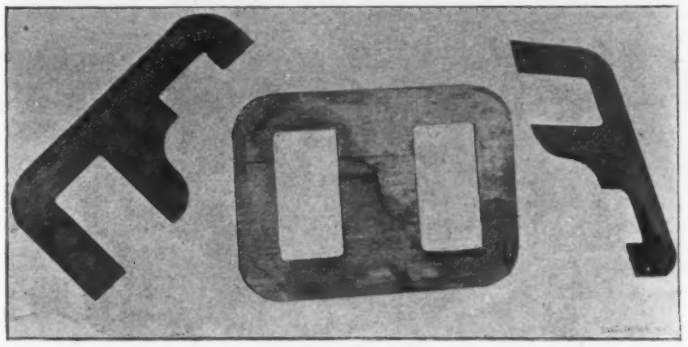


FIG. 19.—TRANSFORMER PUNCHINGS.

is absolutely accurate and very strong, and thus far has not been surpassed.

The alternators are wound with a concentrated winding and are built only as single-phasers, Mr. Wood believing that the problem of transmission of power has been successfully solved by the single-phase, alternating-current motor presently to be described.

Fig. 15 shows the company's small type of belted alternator. It is wound with compounding coils and has a current rectifier. An ingenious feature is that of placing the shunt resistance to the series coils in the pedestal of the alternator, where it is suitably ventilated and at the same time out of harm's way. The machine presents a

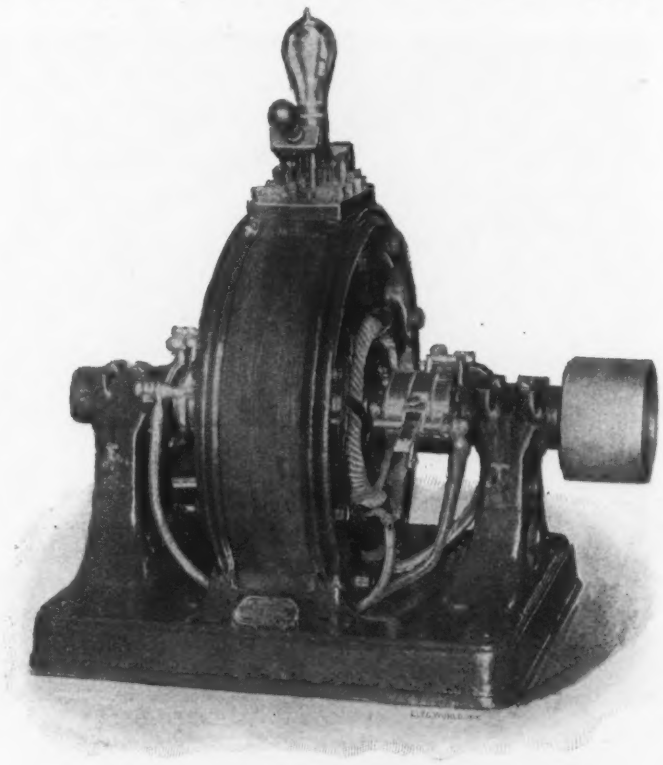


FIG. 20.—SYNCHRONOUS ALTERNATING-CURRENT MOTOR.

very neat and symmetrical appearance. The bearings are self-oiling and self-aligning and well designed mechanically.

The larger belted alternator, shown in Fig, 18, has three bearings, one being on either side of the pulley to counteract the belt pull. The pole-pieces have now become so numerous that it is necessary to strengthen the crown by two ribs on either side as shown. The collector rings and compound rectifier have changed places and the

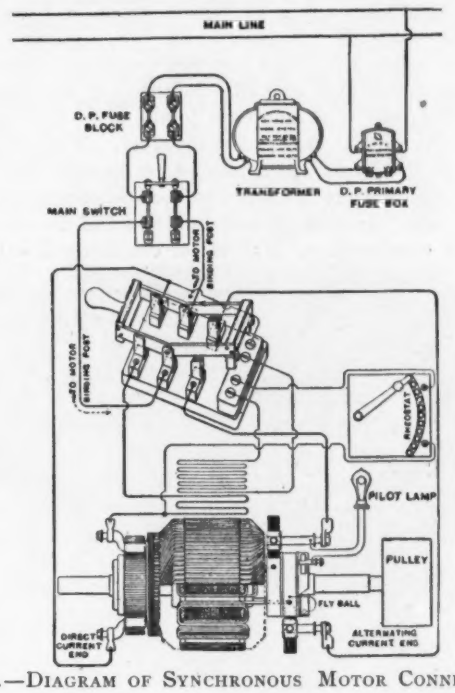


FIG. 21.—DIAGRAM OF SYNCHRONOUS MOTOR CONNECTIONS.

brushes are supported on a rocker bolted to the base of the machine and operated by a small hand-wheel. This rocker permits of the armature being removed without taking off the brushes. The procedure is first to remove the top of the field magnet, then the bearing caps, then the armature. The machine shown is a 4000-lighter, run at a speed of 700 revolutions per minute. Its weight is 16,800 pounds. The exciters supplied with these alternators have the type of field frame shown in Fig. 14. These small machines have a wrought-iron field magnet waist, the rest of the circuit being of cast iron. The bearings are mounted in projections of the pole-pieces, and are bored through at the same time the armature tunnel is

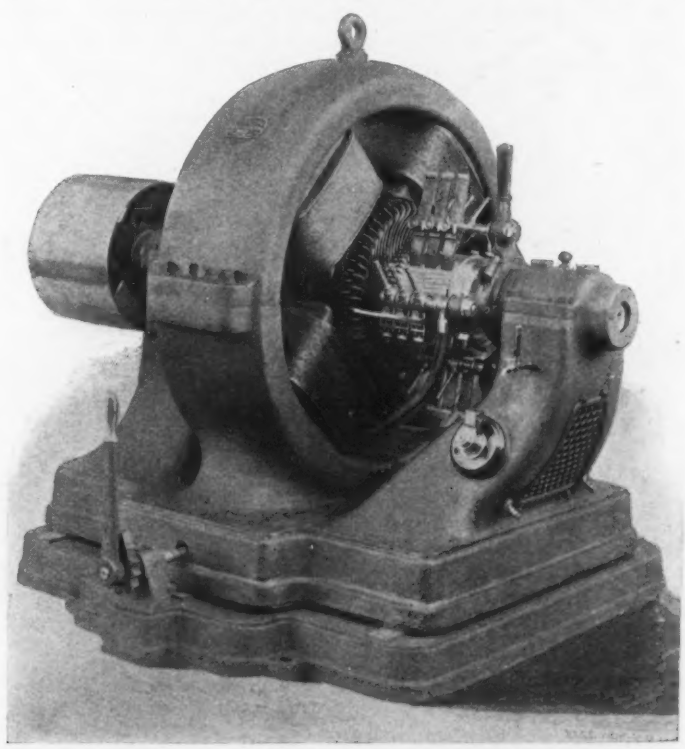


FIG. 22.—DIRECT-CURRENT MULTIPOLAR GENERATOR.

bored. They are bridged with a piece of brass so as to produce no magnetic short-circuit. The armature is toothed, and the machine is otherwise a considerable advance over the ordinary type of exciter furnished with modern alternators. So thoroughly satisfied is the Fort

Wayne Electric Corporation with this type of machine that it is used both as a medium speed motor and bipolar dynamo.

Having described the alternating generators, a description of the other devices included in the output of this company is appropriate. First among these comes the transformer, a piece of apparatus which always affords an opportunity for ingenuity in design, an opportunity which Mr. Wood has not neglected. The shape of the transformer punchings and the method of assembling them are shown in Fig. 19. The magnetic joints, of which there are two in each magnetic circuit, are butted together. When the transformers are stacked the joints are arranged to stagger, and therefore the magnetic continuity is improved by the adjacent continuous surfaces on either side. In order to satisfy himself of the excellence of this method of construction, Mr. Wood constructed a transformer of

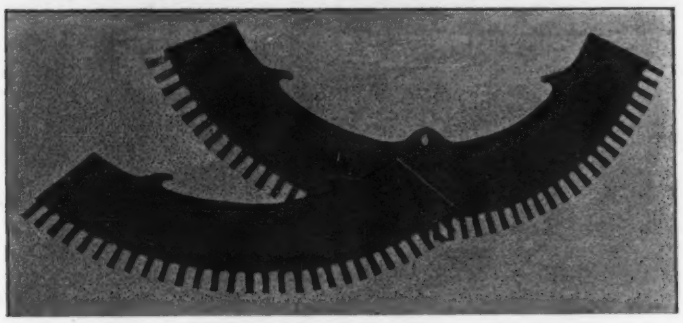


Fig. 23.—Punchings of Multipolar Machine Armatures.

punchings without joints and wound in the coils by hand. A competitive test on this transformer, and one built after the type just described, with separate punchings, showed that the gain from using an absolutely complete magnetic circuit was inappreciable. A complete transformer stacked and in its place is shown in Fig. 17. While thoroughly waterproof, the case is ventilated by slots in such a way that a circulation of air is maintained at all times. This, combined with the very high efficiency of the transformer reduces the heat to a very low figure. The case is arranged so that it may be either bolted to the side of the building, hooked to a cross-arm or placed upon a shelf. The insulation has to withstand a pressure of 8000 volts alternating between the adjacent coils, the core and the case. The transformer is run on full-load for 10 hours after the case is put on, and if satisfactory is ready for shipment. The secondaries can be connected for either 50 or 100 volts. The cases are made in two types, one a specially ventilated type for indoor work and the other for outdoor work, as shown in Fig 16. The primary fuse-box,

Fig. 24.—Winding Multipolar Armature.

which is an ingenious feature of these transformers, is shown on the left of the picture. The hinged cover disconnects the fuses from the line, and each fuse with its porcelain mount can be removed from the box and renewed at pleasure. In Fig. 16, placed between the larger transformers, is a small arc-light transformer having a magnetic circuit so constructed that the transformer can be dead short-circuited with its primary fed from a constant potential source and yet not produce a current exceeding 13 amperes. It can be open-circuited and the voltage will not rise above 80, so that the most perverse alternating arc lamp, when fed by such a transformer, could not blow the fuses or otherwise create a disturbance. The Wood alternating arc-lamp which operates on this transformer burns the ordinary hard carbons and is made in either the single or double carbon type, the latter of which is probably the only alternating lamp of this kind on the market. For a short-burning lamp Mr. Wood has constructed one employing elliptical carbons, which, it is true, are slightly more expensive, but which is less likely to become inoperative, as it has but a single mechanism.

The synchronous alternating-current motor is a production of the Fort Wayne Electric Corporation, which is entirely original

Fig. 25.—Volt or Ammeter Needle.

with it, and is one that bids fair to have a considerable commercial future. The armature of the machine shown in Fig. 20 has two distinct wave windings. One is a direct-current distributed winding and is wound in shallow slots on the outer surface of the armature, while the other is a partially concentrated alternating-current winding placed in deep grooves below the former. The alternating winding terminates in two collector rings and the distributed winding is connected to an ordinary direct-current commutator. The connections of the machine are shown in Fig 21. A multiple contact switch having two combinations in its connections is thrown on the forward switch jaws in starting. By tracing the connections it will be seen that the motor starts as an ordinary series motor. Although it takes considerable current it has a most powerful torque, and can start under a very heavy load. It rapidly

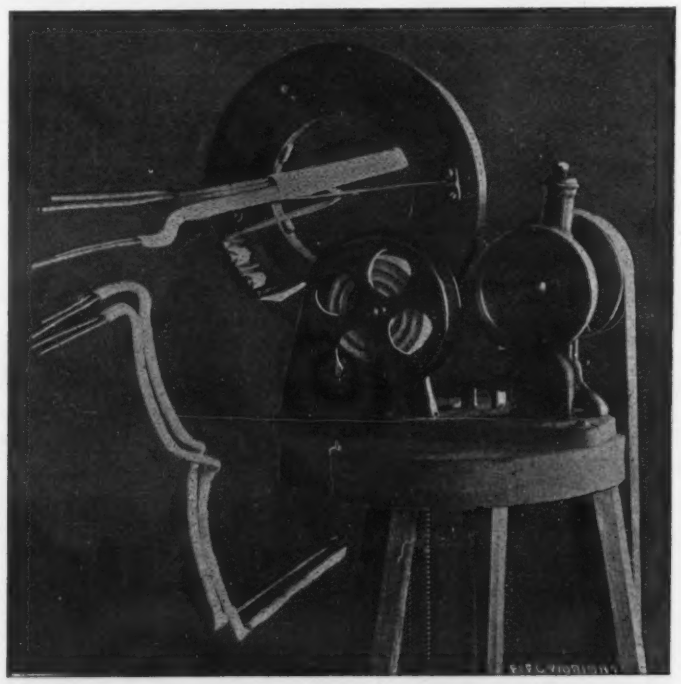


Fig. 26.—Taping Machine.

runs up to synchronism and when this is attained a little centrifugal contact flies out against the side of the collector ring to which is attached a pilot brush. This lights up a small pilot lamp on the top of the machine when the switch is thrown to the other combination of contacts, which, as will be seen from the cut, connects the motor for ordinary synchronous running. The good

properties of the synchronous motor are well known, and now that the difficulty of starting is obviated, its use will be greatly extended. No special transformer or wiring is needed. The motor will carry 50 per cent. overload before it is pulled out of synchronism, when it will immediately stop, but the current which it then takes is not excessive, owing to the great self-induction of the armature. This little machine makes an admirable rotary transformer for charging storage batteries. When in operation its field magnets are excited by the commutated current taken from the direct-current winding. No starting rheostat condenser or other extraneous device is necessary.

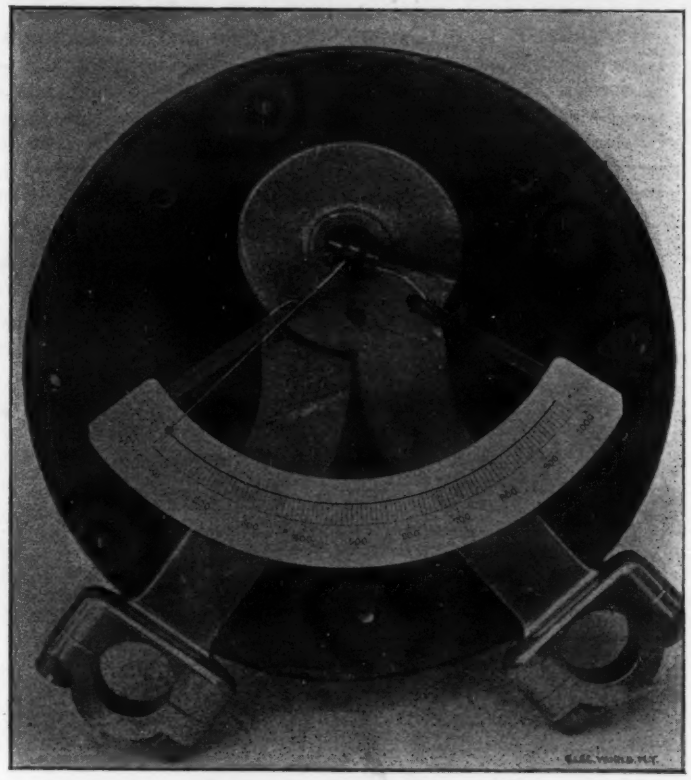


FIG. 27.—INTERIOR OF AMMETER.

The Fort Wayne Electric Corporation has such confidence in these machines that it builds them up to sizes of 10 horse-power, and will build larger ones when so ordered.

FIG. 28.—INTERIOR OF VOLTMETER.

The direct-current machinery of the Fort Wayne Electric Corporation is as interesting as its other products. The bipolar motors and generators we have already referred to and they are pretty well known to the electrical trades. So also are its multipolar generators, a good example of which is shown in Fig. 22, but the details of the construction have never been clearly explained. The field magnets are built in both iron and steel and in the smaller sizes have the general appearance of an alternator-field magnet with the exception that there are fewer poles. The armature is perhaps the most ingenious part of the machine. It is built of punchings each of which forms an arc of the circumference and with the joints broken in the usual manner, but particular interest attaches to their method of attachment to the driving spider. Instead of the customary dovetailed projections fitting into slots, two small hooks are stamped on the inner circumference of the punching. These two hooks abut each other as shown in Fig. 23, and in this manner they clasp the bolts passing through the end discs which press the punchings together, the discs being mounted on spokes so as to form the

FIG. 29.—VOLTMETER.

FIG. 30.—WATTMETER.

driving spider. This is a construction of great simplicity and strength. Fig. 24 affords a view of the completed core and also shows the method of winding. The fields are straight and after being insulated with fullerboard and mica, formed coils, two in each slot, are slipped into place. The armature system is that of spiral end connectors. The coils are taped by the little machine shown in Fig. 26. It is driven by a belt and is thrown in and out by a friction clutch. It does the taping very tightly, accurately and rapidly.

Last, but by no means least in interest are the measuring instruments produced by the Fort Wayne Electric Corporation. They are very simple in construction and yet very accurate and permanent. Their principle is as follows: A solenoidal core is formed either by winding many turns on a spool as in Fig. 28, or a single turn as in Fig. 27, which latter construction answers for an ammeter. Inside of this solenoid is the mechanism which actuates the needle. Gravity forms the restraining force. A piece of iron is mounted on the moving parts, which is thoroughly laminated by slots. This iron is selected with the greatest care and is the purest that can be obtained. It is said to have no magnetic memory. A second piece of iron, which is stationary, is also carefully selected, but is placed in a position so that when the coil is excited both pieces of iron will have the same polarity and therefore repel each other. This repulsion deflects the needle over the scale. However, the law of repulsion is such that if the simple repulsion between the two pieces of iron were used as a deflecting force, the amount of deflection would not be proportional to the current, resulting in a scale, having small divisions at the beginning and increasing in size to the end. To avoid this, Mr. Wood has placed on the mechanism a second little sliver of iron which tends to counteract the action of the first, but being smaller is less powerful and so the first predominates, but the scale deflections are now very nearly proportional to the current and a very even scale results. This device, shown in Fig. 25, is very simple and easy to construct and is said to be permanent and accurate. The external appearance of the instruments is shown in Fig. 29.

The recording wattmeter, devised by Mr. Thomas Duncan, is an ingenious and accurate device. It is only used on alternating-current circuits and consists of two electromagnets having laminated iron cones acting upon an aluminum shell, which rotates on a spindle between them. In the interior of this shell is a little iron bar carrying on either end closed secondaries. The calibration of the instrument is effected by varying the angular position of this iron bar with reference to the field magnets. No brushes or other sliding contacts are used. The meter is retarded in its motion by a disc of copper, which revolves between two magnets, producing eddy currents therein which tend to drag back as the disc is rotated. In Fig. 30, which shows the instrument with the case removed, it will be seen that it has a neat, attractive and compact appearance. Some idea may be obtained of several of the rooms in the works from the accompanying illustrations. Fig. 31 shows the arc lamp department while Fig. 34 shows the assembling of the lamps ready for shipment. Fig. 32 presents a limited view of the press room and Fig. 33 a general view of the switchboard and station equipment department. The shop facilities are ample for carrying on the construction of light and heavy machinery of the several types which have been adopted by the company as standard and as demonstrating the latest advances in these several respects.

This concludes the description of the apparatus made by the Fort Wayne Electric Corporation, a description necessarily contracted and limited in its scope, but still sufficient, we trust, to indicate the most prominent and valuable features both in design and construction which this apparatus possesses.

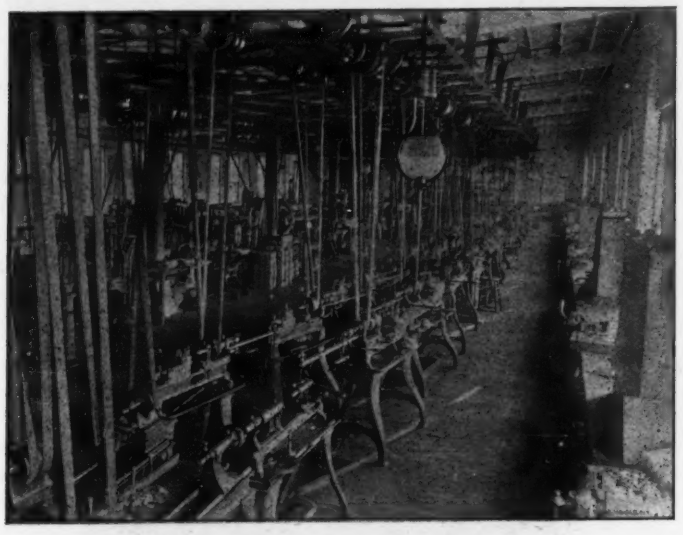


Fig. 31.—Arc Lamp Department.

Fig. 33.—Switchboard and Station Equipment Department.

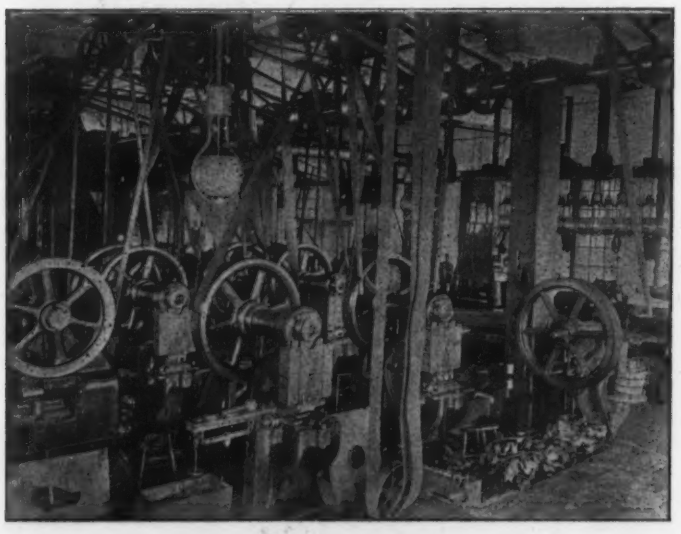


Fig. 32.—Press Room.

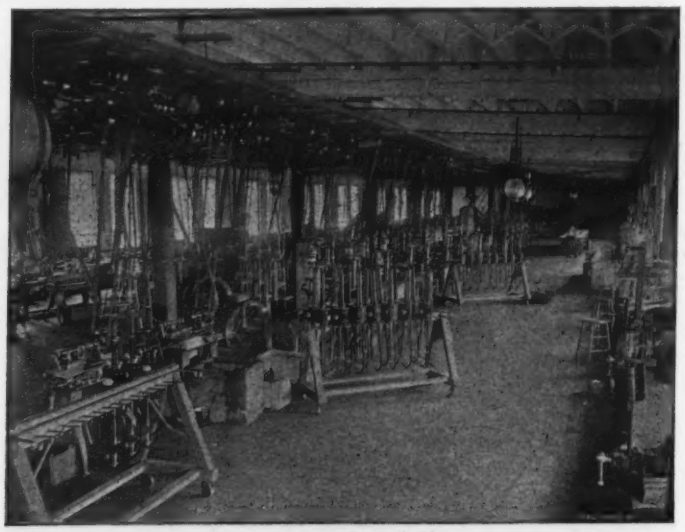


Fig. 34.—Assembling Department for Arc Lamps.

How Can We Prevent Accidents and Increase the General Efficiency of Employees? *

BY W. W. COLE.

There are certain accidents which occur upon the best regulated railways that can never be averted. They are the results of two agencies: Fate and the Fool Killer. And there are others which occur through defective apparatus, poorly conditioned motormen, or gross carelessness of employees. One of the first and most important requisites to improving the efficiency of the road and preventing accidents is in the selection of employees, and to this end the application blank is an important factor, such questions being asked as to generally outline a man's past.

The question, Do you own real estate or personal property? is important, as a man who has accumulated property while working for small pay, must necessarily be economical and appreciate laws governing the protection of property, and is apt to have care for the property of others.

To what extent are you in debt? I think we will concede that a man who is in debt will not only prove a nuisance to a company, but be apt to take but a short-lived interest in his work, and become careless. Constant requests are made upon a company to compel a man to pay his bills, and a company loses many friends unless such matters are given attention.

Do you use intoxicants, and have you ever been addicted to the use of intoxicants? These questions need no comment.

What are the highest wages you ever received? Now the best man for a place is the satisfied man, who thinks he is doing well. And a man who has commanded higher wages than you pay, is sure to believe sooner or later that you do not appreciate his real value, and he becomes dissatisfied, and will either take more interest in looking for another place or in airing his troubles before the other man; and he becomes careless in his duties either way.

The other questions are all such as will tend to delineate a man's stability and character. I believe that all men should be placed under at least $200 bonds, as this will have a restraining influence upon them. So many business men, in order to get rid of a man with little trouble, will give him a first-class recommendation, but will hesitate to go upon his bond unless they know something of his ability, reputation and personal habits. When you employ a man under bonds you have practically got him registered with his friends' approval. Great care should be taken in the choice of instructors of motormen and conductors, and to this end it is well to keep a book recording all acts of disobedience or carelessness of each employee and then select as instructor the man having the best record. It has been my experience that a new man is apt to learn very readily any little tricks of carelessness his instructor may have acquired. After a man has been turned in by his instructor as competent to run I think he should pass an examination as to his duties and upon the rules and regulations of the company. I submit examination papers containing such questions as generally apply to the operation of street railways.

Such an examination is beneficial in several respects. As it makes a man think about his duties, he will discuss the questions with other employees and get their ideas; thus the men will generally take more interest in their work. It also enables them to frame readily into words intelligent answers to questions as to their duties and the rules and regulations. It is sometimes very important that a man should be able to make proper answers to such questions. I think all motormen should be furnished with a blank report, to be filled out each evening, or after his run, as to the condition of his car, and report all troubles with brakes or any defects with running gear or apparatus, and place his report on file with the foreman of the shop, who should have an immediate inspection made of the car reported. The report should be certified by the man making such inspection, and then sent to the master mechanic or superintendent, where verbal reports are made by motormen. The men in the shop are apt to give them careless attention, and when an accident is the result of defective brakes or an armature burns out it is difficult to fix the blame.

When a car has been reported twice for the same trouble, you have a check upon the man who has made the inspection.

One of the most important preventives of accidents is a thorough system of shop inspection, and such reports should be made as would show when a car is in shop just what repairs were made and the time and material consumed. If a car is in the shop for brake shoes, is allowed to go out of the shop and two hours later is again pulled out of service for a split trolley wheel or some loose contact, I should consider that the system of car inspection was faulty. A system of reports in all departments that will form a connected chain to check the work of the individual is of benefit when such reports are not complicated and are always attended to. I do not claim that such a system will make a good man out of a poor one, as my experience has been that it is much easier and the result more satisfactory to discharge the poor man and get a good one in his place; as the process of educating a careless or incompetent man is too much like the horse that fed on excelsior; when he got used to it and relished it he died. Accidents are frequently occurring from loss of power when it is most needed. No road, from an economical point of view, tries to run too close to a theoretical consumption of power.

This is especially the case of small roads operating from five to fifteen cars, and is of special significance where there are grade crossings. In case a trolley flies off, it is apt to be replaced in a hurry with the power on, which means a sudden jerk, especially on a jump-over crossing. Where a road is running close to its full power capacity and the power goes off, it is very likely to be several minutes before the circuit-breakers can be kept in and the car got under motion again. Again, when it becomes necessary to reverse a car to prevent an accident, it is very liable to pull the circuit-breakers out at a most critical moment.

I doubt if a very slow schedule decreases the number of accidents, as I have found that on a division where the cars run slowly people are inclined to take dangerous risks by rushing in front of moving cars, risks which they will not take where the cars are moving at a brisk rate of speed.

To prevent accidents and increase the general efficiency of employees, select them with care; provide a good system for your car inspection, and have a surplus of power.

* Paper read before the New York State Street Railway Convention.

The Motor Power of the Future.

With the exception of a reference to the "infancy" of electricity, and a few more vague fancies, the report of Messrs. Potter, Agnew and Hill before the Niagara Falls meeting of the Society of Railroad Superintendents, is of considerable interest. The committee states that the very great probability of the entire supersession of steam by electricity as a motive power on our railways, not only in suburban and interurban traffic, but in cross-country traffic also, must be admitted. "We have every reason to believe that the steam locomotive of the present day represents the perfection of economy in its peculiar field, or very nearly so, as there are no valid grounds for believing that the application of the principle of compounding will work much of a revolution in economical locomotive practice, and there seems no other direction in which to look with any degree of confidence for a further economical application of steam power. It is absolutely certain that the supersession can only take place in conformity with well-defined laws of progress which must infallibly operate to adequately compensate for all apparent losses incurred during the period of transformation. The 35,000 steam locomotive, on our railways, representing a capital investment of at least $250,000,000, are not to be consigned to the scrap heap on an uncertainty, or even in a hurry. Progress has its own law of compensation for all apparent evils which evolutionary conditions bring to the surface, and it is a law that all arrangements of this character must submit to. We shall be compelled to meet these problems with our present resources as long as possible and manipulate our present instruments for all they are worth, until their insufficiency has been absolutely demonstrated."

Where Prof. Morse Lived and Died.

The dwelling at 5 West Twenty-second Street, New York City, possesses much interest to the telegraphic fraternity. In it Prof. S. F. B. Morse, the inventor of the telegraph, lived for many years and died, these facts being permanently recorded on a white granite slab, which is embedded in the front of the building. The premises are now unoccupied, but are looked after by a caretaker, and it is stated that they will soon give way to a modern business structure. A tree and vines in the area are silent reminders of its famous former occupant, under whose orders they were planted. A one-story extension was used by Prof. Morse as his library, and the same shelves used by him still remain, but they are vacant.

Newspaper Technics.

We often in these columns notice the struggles of non-electrical papers to make plain to their readers what they do not themselves understand.—London *Electrical Review*.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

BY CARL HERING

COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS.

DYNAMOS, MOTORS AND TRANSFORMERS.

Armature Reaction. ROTHERT. *Elek. Zeit.*, Sept. 10.—He points out that the usual way of considering the armature reaction in the calculations of dynamos is unsatisfactory in determining the loss of voltage and he therefore endeavored to devise a different and more satisfactory way of taking the armature reaction into account in making such calculations; this method is claimed to have the advantage that it not only enables one to determine the loss of voltage at a constant excitation but also the increase of excitation for increased loads at constant voltage; with it the magnetic leakage and the armature reaction can be separated. There are two magnetizing forces, that of the field and that of the armature, and their relative position is determined by the brushes; these magnetizing forces he represents by their respective ampere-turns and then combines them geometrically; the resultant ampere-turns as obtained by constructing the usual triangular diagram, divided by the magnetic resistance, gives the resultant number of the lines of force, not taking into account the leakage, which is considered later; this resultant will thereby be given in intensity and direction and from this the E. M. F. of the machine can be calculated. He applies this to continuous-current dynamos, multiphase and single-phase alternators; he considers the multiphase as an intermediate between the continuous-current machines and the alternators; he also discusses the effect of the magnetic leakage. Many tests which he has made have given results which agree very well with this theory.

Speed Regulation of Induction Motors. HELDT. *Amer. Elec.*, September.—The usual well-known methods are given for varying the speed of induction motors; one of these, especially suited where large variations of speed are required, consists in connecting the primary winding to a regulating switch in such a manner that the number of poles may be reduced to one half or any other fraction of the original number by operating the switch; another consists in varying the strength of the magnetic field, which may be done by providing the motor with a multiple primary winding, the parts of which can be connected in series or parallel. In an experiment quoted where the speed of an eight-pole induction motor was 640 it became 1350 with four poles, and 2650 with two poles, the efficiency and output varying very little in the different cases.

Commutator Brushes. WIENER. *Amer. Elec.*, September; an article on the selection of dynamo brushes, their proper contact area and the best pressure.—Different kinds of brushes are described and formulas deduced for the area of the brush contact, the energy loss in them, and for the determination of the best brush tension. Examples are worked out under each of the several formulas; one of these examples is for brushes for a 500-volt, 150-ampere generator, the commutator of which has 90 divisions and a diameter of 10 inches, with two sets of tangential brushes, each covering the width of two commutator bars. In this case the formula shows that there should be four carbon brushes of ⅝ inches x 2 inches section for each of the two brush sets. The best brush tension is found to be 3½ pounds per square inch, at which the energy loss in collecting the current is a minimum and amounts to 1.434 horse-power.

How to Compound a Shunt Dynamo. Amer. Elec., September.—Instructions are given whereby an electrician may compound a shunt dynamo in place with such means as are usually at his disposal. The instructions include a method of determining how much the dynamo should be over-compounded, and for finding experimentally the number of turns on the fields necessary to produce the desired result.

Faults in Dynamos. Amer. Elec., September.—Faults in the armature connections of T.-H. and Brush open-coil arc dynamos are discussed.

Series Reversing Motor. BAXTER. *Amer. Mach.*, Sept. 24.—An illustrated description of a series-motor with the switch and wiring connections for reversing and starting.

LIGHTS AND LIGHTING.

High-Voltage Incandescent Lamp Installations. Lond. *Elec. Rev.*, Sept. 11.—A translation of a short article from the Italian, discussing the relative advantages of high and low voltage incandescent lamps, but containing apparently nothing new.

POWER AND HEAT.

High-Tension Continuous-Current Transmission at Val de Travers. PETAVEL. Lond. *Elec.*, Sept. 11.—A brief description of this installation accompanied by some illustrations. The central station is near Neuchatel, and the current is transmitted for power and light purposes to the manufactories in this narrow valley; the Thury series system is used, the continuous-current being kept constant and the generators and motors being all placed in series; each dynamo gives 65 amperes at 2600 volts; to start a dynamo it is short-circuited until it gives the normal current, which is at about 12 revolutions; it is then switched in series with the others and the speed increased until it takes its share of the load; to cut out a generator the water supply is cut off from the turbine and by an automatic device the dynamo is short-circuited as soon as it tends to reverse; the switchboard is said to be extremely simple for such a system, consisting merely of an ammeter and a short-circuiting switch and voltmeter for each generator; there are four of these generators in series, giving a total voltage of 10,400; all the generators are placed on porcelain insulators supported on brick flooring for which a sulphur cement is used, which itself is a good insulator; the floor of the station is wood resting on porcelain insulators, so that the men can touch any part of the machinery without danger. The total length of the line is 21.8, and is entirely overhead, consisting of a bare copper wire 0.412 inch in diameter. The difficulty of protecting it against atmospheric discharges has lately been overcome by the use of a lightning arrester, of which an illustration is given; it consists of a long pivoted arm with points at each end which are opposite and close to a series of points connected to the line and to the earth; in shunt across one of the air gaps is placed an electromagnetic which causes the arm to swing so as to draw out any arc that may be formed by the current following the lightning discharge; a large self-induction coil is placed between the generators and the arrester and a capacity behind it; it is said to be very efficient. In each village there is a secondary station consisting of a constant-current motor coupled directly to a constant-potential dynamo of 125 volts, which can be raised sufficiently to charge a battery of accumulators at the station; great economy is obtained thereby, for when the water is scarce these accumulators are charged at night only; each motor has an automatic speed-regulator shunting the field magnets; an electromagnet across the terminals of a motor short circuits it in case the voltage rises above a given maximum, a device which takes the place of the fuse in the constant-pressure system; a number of the factories have constant-current motors in series on the main line; the cost of the power varies from $35 to $60 per horse-power per annum.

Transmission of Power in Mines. R. KENNEDY. Lond. *Elec. Rev.*, Sept. 11.—A continuation of his serial discussing briefly the electrical machinery for mines. It seems that the side wall coal cutter has met with more success in England than the other forms; the power should be transmitted through a clutch so that the current need not be switched off continuously; the power required is 7 to 15 horse-power; he prefers a bar cutter for small machines; drilling by electric power is practiced only to a small extent; the percussion drill has not been highly developed; the best forms are of American origin, but a good drill does not yet exist; the only motor suitable for fiery mines is the induction motor; in non-fiery mines electrical transmission is cheaper in first cost and maintenance, more easily applied and has a higher efficiency than compressed air; in fiery mines it is much more efficient and with induction motors quite as safe, although the difference in first cost is not so great.

Rheinfelden. Zeit. f. Electrochemie, Sept. 5.—A brief description of this transmission plant, including a colored map of the district supplied; it is in the neighborhood of Bale, Switzerland.

Electric Welding. RICHARD. *L'Eclairage Elec.*, Sept. 5.—A short, illustrated description of some of the Burton and the Beinswanger apparatus.

Relations of Electricity to Steam and Water Power. EMERY. *Jour. Frank. Inst.*, September; a reprint of a lecture delivered in March.—He shows that no general answer was possible to the question of whether electric power will be cheaper than steam or water power, as the cost depends on the conditions in each particular case; the question of steam and water power and electrical transmission are discussed, as also their costs, with an application made to a specific case; the important effect of the load factor is pointed out. The conclusions of his investigations show that a very large water-power may be developed and the power transmitted locally with advantage in competition with steam-power, even where fuel is cheap, if the cost of construction is kept within reasonable limits; the transmission of power 20 miles from a waterfall is practicable, even in competition with steam-power from cheap fuel, if the power is utilized for 24 hours or if delivered at high tension and distrib-

uted under conditions less exacting than those which obtain in a large city; that when fuel is $3 per ton or over, electrical transmission is very generally practicable. In connection with a number of slides he gave brief descriptions of a number of prominent transmission plants in this country.

Power Absorbed by Machine Tools. PIKE. *Amer. Mach.*, Sept. 24; results of a set of tests made for that journal of electrically driven machine tools at the Baldwin Locomotive Works.—The current, voltage and electrical horse-power are given in each case for the motor only, for the motor and countershaft, and for the whole combination with various loads on the machine; the machines tested were a number of drilling and boring machines, a lathe, planers, slotting machines and a shaper.

Electric Plough. ZIMMERMAN system. *Elec. Jour.*, Sept. 15.—A translation in abstract, and some of the illustrations of the article noticed in the *Digest*, Sept. 5.

Electric Keyway Cutting Machines. *Elec. Rev.*, Sept. 25.—A reprint of the illustration of the machine mentioned in the *Digest* last week.

TRACTION.

Self-Loading Trolley Car for Street Cleaning. *Sc. Amer.*, Sept. 26.—A brief, illustrated description of the Reynolds car; one which is now being built will have a capacity of cleaning 25 miles of streets without stopping.

Trolley Line Between Lakes Erie and Ontario. DUNLAP. *West. Elec.*, Sept. 26.—A brief, illustrated description of this line, the connecting link of which is the Lewiston & Youngstown Railway, a brief description of which by the same author is also given in the *Elec. Eng.*, Sept. 23.

Staten Island Railways. *Elec. Eng.*, Sept. 23.—A brief, illustrated description of the railways on this island.

Repair of Electric Railway Apparatus. SHEPARD. *Amer. Elec.*, September.—The several forms of General Electric street railway motors are considered, the faults to which they are subject are detailed, and instructions for their correction given.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Continental Electrical Engineering Practice. EDGCUMBE and FOX. Lond. *Elec.*, Sept. 11.—A reprint of a paper read at the Students' meeting of the Institution of E. E. They point out some of the distinctive features in which Continental practice differs from that in England. Much attention has been given to extremely efficient slow-speed condensing engines; the units are of considerable size; most stations have a large storage plant in order to run these large units continuously; there is a decided preference for continuous rather than alternating currents, on account of the use of storage batteries; they discuss the question of high-speed and slow-speed engines, believing that the former have the advantage; they discuss the question of how it is that multipolar dynamos may be run at slow speeds without increasing the weight or cost of the machine; cast steel is used in place of wrought iron for the magnets; the armatures are almost invariably a simple gramme ring, with a separate brush for each pole; except in small machines, drum armatures are very rarely found, but for small sizes slotted drums are much used; they give a table showing the relative economy of copper in the transmission by various systems. The alternating-current stations in Germany amount to only 16 per cent. of the total number, and of these about 6 per cent. are polyphase; in France the alternating plants amount to 21 per cent. with 1 per cent. of polyphase, while in England 54 per cent. are single-phase alternating stations, with no polyphase stations at all; in Germany 50 per cent. of all the stations use storage-batteries, which are usually placed in sub-stations; the distributing mains are generally laid on the three-wire system with only two wires from the generators to the sub-stations; in many places plants run for only a part of the 24 hours, batteries being used for the remaining part; the general frequency is 40 to 70; they discuss the question of frequency at some length, concluding that it depends entirely on the character of the load; for small house transformers high frequency should be used, but with large transformers a lower frequency is better, whereas for a motor load a much lower one is advisable. The relative economy of transmission by the various alternating systems is discussed at some length and it is concluded that the three-phase system is considerably the most efficient; it is much more largely used on the Continent than the two-phase. A brief description of the Cassel plant using single-phase synchronous motors is given. For small sizes the induction motors are usually used, the armatures being short-circuited; for larger sizes, starting devices are used, a resistance being usually placed in the armature circuit, since, for a given current a greater torque is thus obtained than if the resistance is placed in the main circuit; for hoists where a large starting torque is required no starting resistance is used, a slip of 12 per cent. being allowed, giving a starting torque of two or three times the normal; the efficiency of a three-phase plant is nearly if not quite as high as that obtained in Germany with continuous-current machines; polyphase motors will give about 30 per cent. greater output with 7 to 8 per cent. better efficiency than single-phase machines of the same price and weight, but polyphase transformers cost considerably more than single phase; it is the almost universal practice in both generators and motors to embed the conductors in slots or holes in the periphery of the armature and field; a plant at Dresden is briefly described as a sample of the three-phase installations; the Oerlikon works uses three-phase non-synchronous motors without a starting resistance, while the Siemens & Halske works uses continuous-current motors exclusively. A considerable reduction is allowed in charging for current for power purposes; the motors installed in Paris amount to about 2 per cent. of the whole power, their average size being three horse-power; in Berlin motors are installed for about 1500 horse-power, which is 12 per cent. of the total output; in the new station the price for motor currents will be only 2.2 cents per kilowatt-hour. In many cases the central-station voltage is regulated by automatic means; in Berlin two systems are used for indicating automatically the existence of a fault and the feeder on which it occurs; in Dresden the speed of the engines is regulated by a small motor moving a counterweight on the governor, thus allowing the speed to be controlled from the switch gallery.

Central-Station Statistics. ROSS. *Elek. Zeit.*, Sept. 10.—A short article making some deductions from the statistics of Continental stations noticed in the *Digest*, July 18 and 25 (see also Sept. 5); he calculates the relation between the greatest hourly output and the total yearly output, which figures vary very greatly and cannot be averaged; the highest is 82 per cent. for the Darmstadt and the lowest 26 per cent. for Stockholm; the corresponding figures for the leads are also given, the figures being relatively quite different. These figures are of interest only in connection with a knowledge of the respective systems and conditions and they are therefore not abstracted here.

Operating Costs of the Stations in Vienna. GOLDENZWEIG. *Zeit. f. Elek.*, Aug. 15.—Some of the figures for the two large stations in Vienna, from 1892 to 1896.

Electric Light on Vessels. CRAIG-BROWN. Lond. *Elec. Eng.*, Sept. 11.—An article discussing the subject from a practical standpoint, pointing out the difference between such a plant and one on land and giving the arguments for and against the double, single and concentric systems of wiring.

Automatic Switch. DAVY system. Lond. *Elec.*, Sept. 11.—A brief, illustrated description of a switch, the object of which is to automatically switch incandescent lamps in the place of an arc lamp after any predetermined time, such as at midnight; it is a mercury switch contained in the base of the arc lamp, its operations being controlled from the central station; the description is not very clear.

Municipal Ownership. *Amer. Elec.*, September.—An editorial on the collection of statistics to illustrate the defects of municipal ownership of electric lighting plants. The best plan for the emergency is claimed to be one which will recognize the honesty and sincerity of those who advocate municipal ownership, and direct all endeavors to showing that however well founded that principle may be, its practical application will entail greater expense on a community than electrical supply by a private enterprise; the statistics required for this purpose are those showing the total outlay on a given plant from its inception, the taxes, depreciation and other charges often disregarded in municipal bookkeeping, the manner in which a plant is keeping pace with modern developments, and the extent of its patronage by the community as compared with private plants in similar communities; such statistics, it is stated, cannot be compiled through correspondence but will require personal investigation and entail considerable expense, which, however, will be justified by the results.

Equalizer of Compound Dynamos. TRYON. *Amer. Elec.*, September.—It is suggested that if equalizer switches are used they should have a much more efficient contact than the ordinary jack-knife switch-jaw; a substantial mercury contact is recommended; he has seen fuses in equalizer circuits, which practice is to be condemned, as the failure of the fuse would cause almost instant reversal of current in the dynamo to which the equalizer is feeding current.

Electricity in Naval Life. FISKE. *Elec. Eng.*, Sept. 23.—The beginning of a reprint of a treatise from the *Transactions of the Naval Institute;* the first portion is general in character, and begins a discussion of the specific applications.

Electricity on Board Ships. EICKENRADT. *Elec. Jour.*, Sept. 15.—A reprint of paper noticed in the *Digest*, Aug. 1.

Toulouse. *West. Elec.*, Sept. 26.—A brief, illustrated description of this water-power plant with accumulator sub-stations.

WIRES, WIRING AND CONDUITS.

High Conductivity Cable. Lond. *Elec.*, *Elec. Rev.* and *Elec. Eng.*, Sept. 11.—An illustrated description of an armored electric light cable, in which the armor acts as the return circuit; in the ordinary cables of large size the weight of the armor required for conductivity is very great, thus making the cables very large; in the present form the armor is made of iron or steel, having a cross-section like a keystone, with copper wires running lengthwise through holes made of semi-circular channels in the adjoining faces of the armor; the copper acts as a return conductor, while the iron or steel segments, which are locked by the wire, provide the mechanical protection.

Calculation of the Transmission Lines for Railways. PROPOSTO. *L'Eclairage Elec.*, Sept 5.—An article of some length, in which he en-

deavors to apply the Kelvin law for the most economical cross-section to the transmission lines for railways; he assumes that the current and the time during which it is applied are known; the method which he develops is a somewhat laborious one, but he thinks that the importance of calculating the proper size of the wires warrants taking this trouble.

Air-Drying Process for Telephone Cables. Weitlisbach. *Elec. Eng'ing*, September.—A short article describing the method now adopted throughout France for drying cables, which consists in forcing dry air through the lead pipes containing the cotton or paper insulated cables; the entrance of moisture in such cables renders them quite unfit for service; one of the principal advantages of the method is the facility of repairing faults; if a fault exists, dry air is forced into the cable from both ends, which will after a few hours raise the insulation sufficiently to enable the cable to be used, after which the hole in the lead covering is soldered; an illustrated description of the machinery for the air-drying plant is given.

Manufacture of Wire. Perrin. *Elec. Eng'ing*, September. A continuation of his serial (see *Digest*, March 7).—He discusses the subject of galvanized wire and its manufacture, and of stranded copper wire, giving a table of the number of strands for different-sized cables; a diagram is given showing the comparative sizes of wires of different gauges.

Telephone Cables. Weitlisbach. *Elec. Eng.*, September.—He discusses the subject of talking through cables, and the effect of pitch and other qualities of the voice; he then shows how the cables should be constructed so as to meet the requirements pointed out and to diminish the cross-talking, after which the subject of retardation is discussed.

Interior Wiring. Amer. Elec., September.—An article on switch control for electric signs. A working drawing is given of a commutator for progressive switching, to be driven by a motor. The segments of the commutator can be adjusted so as to enable numerous combinations to be made.

ELECTRO-PHYSICS AND MAGNETISM.

Selective Absorption of Röntgen Rays. McClelland. Lond. *Elec.*, Sept 11; an abstract of a Royal Society paper.—The effects were measured by the falling of the charge of a disc; comparisons were made with glass and tin, to which other substances were compared; with some of these there was no selective absorption, and with others it was very marked; glass, mica and paraffin give little or none, but with fuchsin, eosin, fluorescin, æsculin and barium sulphide the effect was very marked, as also with several fluorescent screens; the results are given in the abstract in a table; he concluded that Röntgen rays are of different kinds. With another less efficient tube, with a greater air pressure, there was no selective absorption, the rays being homogeneous; with another tube which was more efficient, but not as good as the first, there was evidence of selective absorption, but not so marked as with the first; it seems therefore that as a tube becomes more efficient the rays given off become less homogeneous.

Röntgen Rays. Lond. *Elec.*, Sept. 11; notices of a few papers from the *Wied. Beiblätter.*—Marangoni showed how the larvæ of insects infesting grapes and other fruits may be photographed inside of the fruit. Stefanini reports having observed no action of an electrostatic field upon X-rays; they cannot be deflected even by a rapidly rotating ebonite plate which they traverse; sensitive plates contained in a box exposed to sunlight show no effect unless a phosphorescent sheet is used, but the latter produces phosphorescence by the heat; the action may be produced by merely heating to 40 degrees C. Villari shows that vacuum tubes are statically charged not only by the cathode rays, but also by those from the anode; he obtained characteristic figures by blowing a mixture of sulphur and red lead on the tubes. Lussana and Cinelli communicated to a foreign academy that they had discovered a law according to which any conductor exposed to Röntgen rays and protected against electrostatic effects assumes a final potential of 0.44 volt, no matter what the initial potential or current, the distance, or other circumstances.

Electric Convection Along the Lines of Force of Röntgen Rays. Righi. *L'Eclairage Elec.*, Sept. 5; abstracted from *Comptes Rendus*, 123, page 399.—He gives the results of some experiments.

Contact-Breaker for Induction Coils. Paine. Lond. *Elec. Rev.*, Sept. 11.—A brief description of a form of break the object of which was to increase the number of breaks, believing that this will give better results for vacuum tube lights. The hammer which breaks the circuit is operated by a separate battery and magnet, and vibrates between two contacts, both of which are in the circuit of the primary of the induction coil; thus for every vibration of the hammer the primary current is broken twice instead of once; its vibration is also quickened; he finds no improvement in immersing the contacts in oil as the oil soon carbonizes.

Electric Discharge in a Magnetic Field. Salomons. *Phil. Mag.*, September.—A long, illustrated article describing briefly a number of points of interest in connection with vacuum tubes, the outcome of work extending over 25 years; it refers chiefly to the bands formed in the tubes and the reason of their existence. He found that by using high voltages as usual several superposed phenomena were produced and he therefore used voltages as low as 700 and rarely over 2000 in order to get the various phenomena in their purity; an illustration of the specially constructed magnet which he used is given. Among some of the points brought out in the paper he shows that vacuum tubes are very useful for exploring magnetic fields; in another case he shows a magnetic means for converting an alternating current into two currents of a direct intermittent type which can be so coupled as to form an intermittent direct current in one direction; so far he has succeeded in doing this with very small currents only.

Passage of Electricity Through a Gas. Paalzow and Neesen. *L'Eclairage Elec.*, Sept. 5; abstracted from *Wied. Ann.*, Vol. 56, page 276.—They discuss the relations of the discharge to the various pressures of the gas.

The Transverse Effect in Bismuth. Beattie. Lond. *Elec.*, Sept. 11; abstracted from the *Trans. of the Royal Society of Edinburgh*, Vol. 38.—This effect, though allied to the Hall effect, has not been proved to be proportional to the first power of the magnetization; he thinks it is really the sum of three separate effects; he finds the following modifications of the effect; with thick plates the transverse current does not change its direction for any strength of magnetic field, though in some cases a maximum value is reached and passed; with thinner plates the transverse current is positive for strong fields, negative for weak ones. The field strength at which vanishing takes place is the same for the same plate, so long as it is modified only in length and breadth; but if the plate be planed thinner, the field at which the current vanishes is stronger than in the original case; similarly, if the original plate be hammered, the field required to produce the vanishing of the effect is increased; a combination of hammering and planing raises the required field strength very considerably. In one sample of certainly pure bismuth the ratio of the increase of resistance to the square of the transverse effect was practically constant.

Damping Action of a Magnetic Field on Rotating Insulators. Duane. *Phil. Mag.*, September; abstracted briefly from *Wied. Ann.*, No. 7.—The results of experiments described, showing that if an insulator is rotated in a magnetic field about an axis at right angles to the lines of force, a damping action is exerted in opposition and nearly proportional to the angular velocity.

Dissipation of Energy in Magnetization. Weiss. *L'Eclairage Elec.*, Sept. 5.—An article of some length discussing the Steinmetz law and the influence of the heterogeneity and discontinuity of the material in the application of this law; he gives experimental results with very small cycles, endeavoring to find up to what point the measurements with alloys of iron and antimony and with magnetite agreed with this law.

Magnetization of Liquids. Townsend. Lond. *Elec.*, Sept. 11; a mention of a paper communicated to the Royal Society.—He describes experiments made to determine the coefficient of the magnetization of liquids; also the effect of temperature, which latter show about the same temperature coefficient at points corresponding to the same temperature.

Cathode and Röntgen Rays. J. J. Thomson. *Science*, Sept. 18. *Elty*, Sept. 23.—A reprint of his presidential address at the recent B. A. meeting, which is devoted almost entirely to this subject; he discusses the nature and properties of these rays; like most of the papers of that writer, it is full of interesting information clearly stated. There are two views held as to the nature of cathode rays; one of these is that they are particles of gas carrying charges of negative electricity and moving with great velocity acquired by traveling through the intense electric field in the neighborhood of the negative electrode; phosphorescence is according to this view produced by the impact of these particles, although it is an open question whether this is due to mechanical or electrical causes; this view of the constitution of cathode rays has received strong confirmation from the results of recent experiments by Perrin, which are briefly explained; they prove that cathode rays carry a charge of negative electricity. The other new view is that cathode rays are waves in the ether, but it is difficult to thus account for the results of some experiments; Lenard's discovery is not incompatible with the first views expressed; the present writer favors this first view; there are no crucial experiments which show unmistakably that Röntgen rays are waves of transverse vibration in the ether, or that they are vibrations at all; he discusses the question whether there is any property possessed by these rays which is not possessed by some form of light, and in this connection cites the well-known experiments of Becquerel with uranium salts; the absence of refraction and perhaps of polarization are the two respects in which the rays differ from light; he discussed the relations of the refractive index and the frequency, concluding that the absence of refraction instead of being in contradiction to the Röntgen rays being a kind of light, is exactly what we should expect if the wave-length of the light were exceedingly small; at present he thinks we may say that although there is no direct evidence that they are a kind of light, there are no properties of the rays which are not possessed by some variety of light; if they are light rays, their wave-lengths are of an entirely different order from those of visible light. He discusses the property of these rays of making a conductor of non-conducting materials.

Facts and Fancies About X-Rays. SMITH. *West. Elec.*, Sept. 26.—A brief statement of what he calls facts, which he says are little understood. The X-rays are invisible and the objects themselves are not seen; they possess no more if as much germicidal or curative power in the body as ordinary sunlight; in general, nothing can be photographed in the body except the bones and a few hard tissues, calcareous deposits or foreign substances; the deeper and softer parts are invisible; the hopes of many of the most conservative investigators have been far from realized; it is impossible to penetrate the thicker parts of the body so as to be of any practical importance.

Röntgen-Ray Discharges. PERRIN. *Elec. Jour.*, Sept. 15.—A reprint of the article from the Lond. *Elec.*, noticed in the *Digest* last week.

X-Ray Photographs of a Mummy. West. Elec., Sept. 26.—A reproduction of some sciagraphs of a hand and a foot of a mummy.

Sympsychograph. JORDAN. *Pop. Science Mo.*, September.—A short article on the photographing of thoughts, with an illustration, which is claimed to be a photograph of the thoughts of a number of persons; the photograph shows a number of indistinct images of a cat. The article cannot be classed as a scientific one, notwithstanding the reputation of that journal; the eyes of the observers were, for instance, said to have been electrically connected with the compound lenses of the photographing apparatus. The New York *World* published a short article reprinted in the *West. Elec.*, Sept. 26, stating that the photograph was made by Prof. Sanford of seven composite views of a cat for the purpose of "assisting in this hoax upon the innocent public. President Jordan is now in Alaska hiding from the consequences of his deed."

Address Before the Mathematical and Physical Section of the B. A Meeting. J. J. THOMSON. *Science*, Sept. 18; *El'ty*, Sept. 23.—A reprint of his address as president at the recent meeting. It is devoted almost entirely to the subject of cathode and Röntgen rays, an abstract of this portion appearing elsewhere in these columns. In the last part he discusses the question of the movement of the ether, showing the importance in the electromagnetic theory of a knowledge as to whether or not there is any ether motion in a varying electromagnetic field; a number of experiments are cited.

Static Brush Discharge. FESSENDEN. *Amer. Elec.*, September.—In answer to a query that appeared in a preceding issue as to the cause of a wire giving off light when excited from a static machine, he writes that "any wire, unless highly polished or covered with a perfect insulation will appear luminous in the dark if its potential be raised to about 20,000 volts. If the line were broken and well insulated from the ground and the static machine gave a one eighth inch spark, the phenomenon decribed will occur."

ELECTRO-CHEMISTRY AND BATTERIES.

Action of Magnetization on E. M. F. BUCHERER. *Phil. Mag.*, September; abstracted briefly from *Wied. Ann.*, No. 7.—The results of his investigations are briefly that if one or two iron electrodes in a neutral solution of ferrous salts is magnetized, there is no E. M. F. produced greater than 0.00001 volt; the forces produced by magnetizing a circuit which contains magnetic substances as electrodes are to be ascribed to variations of concentration which the magnetized electrode produces when dissolved. In the case of ferric salts, the direction of the currents produced by magnetization depends almost exclusively on their degree of concentration at the two electrodes. If only ferrous salts are present, the direction of the currents produced by magnetization depends on the total concentration of the iron salts. The currents designated by Rowland as primary ones are agitation-currents.

Electro-Chemistry and the Technics of Energy. BUCHERER. *Electrochem. Zeit.*, September.—An appendix to the recent article published in the May number of that journal (see *Digest*, June 6) in which he develops a theory which differs from that of Nernst and Ostwald.

Chemical Analysis by Means of the Telephone. KOETHNER. *Zeit. f. Electrochemie*, Sept. 5.—A brief abstract of a paper in which he calls attention to the difficulties in making quantitative analysis of certain alkaline salts, especially in the separation of rubidium and potassium and shows how these difficulties can be overcome by measuring the electrical resistance of the solution by the Kohlrausch method; he states that the conductivity of a mixture of these salts is directly proportional to the "ratio of the mixture"; the difficulty encountered is to keep the temperature the same; Ostwald suggested to overcome this by having the standard resistance in the same bath as that to be measured and to make the resistance equal by the addition of known quantities to the unknown solution; the original suggestion was to have standard known mixtures with which to compare the resistance of the unknown mixture.

Electrolysis in Raw Sugar Factories. EHRLICH. *Electrochem. Zeit.*, September.—An extract of some length of the recent report of Baudry on the process used in Stapanowka and Woronowitza (Russia), where the process has been in successful use for some time; he shows among other things that electrolysis acts on certain materials in the liquor which are not sugar, with more power than the lime; it deposits almost three times as much of the nitrogenous materials as the lime; the original report says that all things considered, electrolysis is a great aid; it is thought that in the future it will be possible to make the process much more effective.

Treatment of Molasses by Electrolysis. Lond. *Elec. Rev.*, Sept. 11; a brief editorial abstract of an article in the *Zeit. f. Electrochemie*, April 20.—Some experiments are described to increase the profit in sugar factories by improving the quality of the bi-product, enabling it to command a higher price, rather than to attempt to extract more crystallizable sugar from it; by the electrolysis of the molasses he succeeded in raising the percentage of potassium carbonate from 53.44 to 64.44 per cent.; from a monetary point of view the improvement appears to be balanced by the power consumed, but it is thought that if the chlorine could be used for producing bleaching powder, the process would offer decided advantages.

Preparation of Permanganate of Potassium and Pyrochromate of Potassium. LORENZ. *Zeit. f. Electrochemie*, Sept. 5.—A brief mention of an article from a German chemical journal describing a process in which he electrolizes potassium hydrate between a porous electrode of copper oxide as a cathode and a rod of manganese (or ferro-manganese) or ferrochromium as an anode, the voltage required being 1.5 to 2.

Theory of the Lead Accumulator. LOEB. *Zeit. f. Electrochemie*, Sept. 5.—A reprint of his discussion of the recent paper by Elbs (see *Digest*, Sept. 19) with whose theory he does not agree; he believes that his own theory agrees better with facts than that of Elbs; he admits, however, that the question of the action in an accumulator is by no means solved.

Accumulator. Zeit. f. Elek., Aug. 15.—A short article giving the data in the form of colored plates of a new accumulator near Vienna, the capacity of which is claimed to be quite high; no description is given.

Equipment of Electrochemical Laboratories. KRUEGER. *Electrochem. Zeit.*, September.—The conclusion of his long series of articles.

Electrolytic Copper and Silver Refining. Amer. Elec., September.—An illustrated article descriptive of the electrolytic refining plant of the Guggenheim Smelting Company, at Perth Amboy, N. J. This plant has an annual capacity for about 10,000 tons of copper and 30,000 ounces of silver. The copper cathode plates are electrolytically formed separately into thin shells and then placed in the regular copper refining baths. The anodes weigh 275 pounds, and the electrolytic reduction of each requires about 24 days of 24 hours. The intensity of the current varies from 7 to 20 amperes per square foot, the lower density being used with copper rich in precious metals. There are 360 tanks for copper refining, each containing 22 anodes in parallel; all the tanks are connected in series. The voltmeter at the switchboard registers from 117 to 120 volts, with 1500 amperes. The Moebius process (see *Digest* last week) is used for silver refining. There are 48 silver refining tanks, each of a capacity for from 600 to 700 ounces of silver per 24 hours; each tank has 24 anodes in parallel, and all the tanks are connected in series. The cathode consists of a silver belt which is always kept in motion and upon whose surface the silver is deposited from the anode and removed by scrapers located at one end of the tank. The surface of the belt is about ½-inch below the lower surface of the cathodes and is made of a sheet of pure rolled silver 15 inches wide, 31 feet long and weighing about 40 pounds. Each of the anodes, which are 12 x 3 inches and 1 inch thick, usually contains 100 ounces of silver and from 3 to 8 ounces of gold.

Anaconda Electrolytic Copper Refinery. Eng. & Min. Jour., Sept. 19.—A long, illustrated description of this plant in Montana which is of considerable interest, not only because it is the largest plant of the kind in existence but also because it is one of the best and most economical in its workings; a total of 3000 horse-power is used.

The Study of Storage Cells. WILLIAMS. *Elec. Jour.*, Sept. 15.—A reprint of a long thesis constituting a short treatise on the subject of storage batteries.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Localization of Faults in Electric Light Mains. RAPHAEL. Lond. *Elec.*, Sept. 11; a continuation of his serial.—In the present portion he describes in detail the localization of faults by means of a search coil, which consists merely of a large portable triangular coil, with a telephone or galvanometer in circuit; one side of this coil is held close to a main, through which an interrupted current is passed, thus inducing a current in the coil; if there is a fault on the positive side, for instance, this coil is held near one main on the positive side and the negative busbar is then momentarily connected to earth; if the fault is in that main the current will be momentarily increased, which will be indicated in the instrument; if this does not take place, the same test is made with the next main and so on; the ordinary electric bell may be used as the interrupter. The method would also give good results in times of light load, for a closed network, the fault being then between the feeder, which would induce the greatest current and the one which induces the next greatest. This method may be used in the streets by carrying the coil over the pavement; illustrations of this application are given; the point where the sound ceases will be where the fault is, but this is true only in some cases, as with bare copper strips or networks of unarmored cables in non-metallic conduits, where very good results can be obtained; but when cables are lead-covered or

armored, or in metal pipes, the sound does not decrease at the fault but continues until one passes an interruption in the continuity of the metal covering; the method has been used with success at Troyes, France, where lead-covered cables are used, the continuity of the lead is broken at all the joints; the fault is generally at the joint previous to the one where the noise ceases. The current from a Brush or Thomson-Houston arc machine is sufficiently discontinuous to be used without an interrupter; the average size of the coil is a triangle of three feet to the side with a couple of hundred turns of No. 26 or 30 wire; he has heard it said that the method can be used during supply hours without earthing the healthy main but proof that this can be done is still wanting. The methods of Latch and Thayer, of American origin, are briefly discussed.

Measuring the Insulation of Three-Wire Circuits While in Use. Aliamet. *L'Elec.*, Aug. 29.—A description of the method devised by Place. A high resistance voltmeter is placed successively between the positive lead and the earth, the negative ead and the earth and between the two leads, while an ampere-meter is placed between the neutral wire and the earth; with the data thus obtained he deduces the mathematical expressions for the insulation resistances of each of three leads; these formulas are not very simple when, as is usual, the neutral wire is not well insulated.

The Use of Bare Wire for Resistance Coils. Burstall. *Phil. Mag.*, September.—An article of some length showing the advantages of resistances made of bare wire immersed in oil as suggested by Griffiths and describing their construction, as also tests made with them. The chief advantages are that the heating by the testing current is much less than with covered wire and that the temperature of the wire can be accurately measured; another advantage is that the wire can be annealed in the most perfect manner by the passage of a sufficiently large current to heat it to a red heat for a few seconds; it has been long known that well annealed coils are much less liable to change than coils which have not been so treated; he used platinum-silver wire throughout; an illustration of one of the coils is given; the containing box is lined with copper for the reception of the oil which is a pure, heavy hydrocarbon, free from any trace of alkali or acid. He gives a large number of figures showing to what extent bare wire coils may be trusted; there is no reason to suppose that if they are constantly kept in an oil bath and the oil kept free from water that any considerable alteration can take place.

Testing Apparatus. Lond. *Elec.*, Sept. 11.—A brief, illustrated description of a universal testing key and a new form of high resistance for use in submarine cable testing; the former does away with many connections and combines the various keys in one apparatus; the resistances are for 1 to 100 megohms; over a cylinder of ebonite a semi-conducting paste is laid, made of ebonite and lampblack, which is afterward vulcanized; wires are embedded in the ends of the cylinder to serve as leads; for a high resistance a deep screw thread is cut through this material into the insulating material beneath, thus leaving a spiral coil.

Measurement of Very Large and Very Small Alternating Currents. Campbell. *Phil. Mag.*, September.—A reprint of his recent Physical Society paper (see *Digest*, July 11); it is followed by a short appendix.

Drawing Alternating-Current Curves. Drexler. *Elek. Zeit.*, Sept. 10.—A reply to the criticisms of Rodgers and Burnie (see *Digest*, Aug. 8) of his method (see *Digest*, May 23 and July 18).

Galvanometers. Armagnat. *L'Eclairage Elec.*, Sept. 5.—The beginning of a long, illustrated article, which appears to be a sort of treatise on galvanometers, giving the formulas involved in their use.

Testing Department of the General Electric Company's Works. Straus. *Elec. Eng.*, Sept. 23; a continuation of his serial.—All the guarantees of the machines are actually carried out before shipment; the machines are run with the same brushes and fittings that are to be used after being permanently set up; all machines receive the regular commercial test, a brief description of which for a compound-wound three-phase generator is given; these are tested for resistance, heating and compounding; the resistances are carefully measured with a Wheatstone bridge and by the fall of potential method and are accurate to within half a per cent.; these are taken before and after the heat run, and the temperature calculated therefrom is checked by the direct measurement with a thermometer, taken after a continuous run with a 10 per cent. overload until the permanent condition is reached; the standard for insulation resistance of the machines is one megohm, anything less than this not being passed.

Measuring High Resistances. McKissick. *Amer. Elec.*, September.—Formulas and connections are given for measuring very high resistances and insulations by means of the Weston voltmeter.

Condenser for Very High Potentials. Amer. Elec., September.—Directions with illustrations for making a condenser for very high potentials, such as those of so-called Tesla currents; the condenser consists of glass and ferrotype metal plates immersed in oil. One of the chief practical features of the condenser is claimed to be the facility with which it can be repaired. A punctured plate may be at once withdrawn and renewed without otherwise disturbing the condenser, at an expense which is said to be practically negligible.

Condenser. Tesla system. *Elec. Rev.*, Sept. 23.—A reprint of his recent patent.

Electric Motor-Meters. Duncan. *Am. Elec.*, September.—An article on the care and management of electric motor-meters, including diagrams for connecting them and a form of meter record; directions are given for installing meters, and practical information as to their care, inspection, methods of checking, reading, etc.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Telegraphy in Europe. Elek. Zeit., Sept. 10.—A table of data for all the leading European countries taken from the Austrian Government statistics, giving the tariff, the number of telegraph stations per area and per inhabitants, and the number of messages per thousand inhabitants, for the year 1894; among these are the following for the leading countries: For Great Britain and Ireland the tariff for 10 words was 10 cents; there is a telegraph station for every 33 sq. km, or for every 3969 inhabitants; the number of paid messages per thousand inhabitants was 1894; for France these figures are 8 cents, 47 sq. km, 3382 and 1017; for Germany, 10 cents, 27 sq. km, 2483 and 649; the statistics include 23 countries.

The Telegraph in the Ashanti Expedition. Lond. *Elec.*, Sept. 11.—Some data and descriptions taken from official sources regarding the construction, maintenance and working of the telegraph in this recent expedition.

The Proposed Solution of the Telephotic Problem. Huber. *Elec. Eng.*, Sept. 23.—A suggested solution of the problem of transmitting images, accompanied by a diagram of the arrangement; he calls it the telephote. By means of a lens the image of an object is formed on a thin film of selenium, which changes its resistance when illuminated; two thin metallic springs are made to vibrate rapidly over the image, being operated by a tuning fork; the electric current passes from one to the other over the film and is varied by the resistance encountered in passing through the selenium; these variations produce induced currents in a sort of transformer, which are sent over the line to the receiving station. The receiver consists of a synchronous tuning fork supporting a Crookes tube enclosed with a film impermeable to X-rays and provided with a fine aperture through which the X-rays pass on to the usual screen, on which it is thought that the image will be formed and can be seen by means of a lens; it appears that the line currents are supposed to produce X-rays in a Crookes tube. The device is a mere suggestion which it appears has not yet been carried out.

The Telephone Convention. De Land. *Elec. Eng'ing*, September.—A brief report of the proceedings.

MISCELLANEOUS.

Magnetic Concentration of Iron Ores. Wedding. Lond. *Elec. Eng.*, Sept. 11—A reprint of a paper read before the Iron & Steel Institute, discussing the subject of roasting iron ores with a view to their magnetic concentration; he shows the importance of converting non-magnetic ores into magnetic ones and describes some of the processes; he referred to the necessity of studying the temperatures and showed the usefulness of Le Chatelier's pyrometer, which he has improved; the substitution of an asbestos for a china clay overcame some of the difficulties before experienced in getting pure platinum and rhodium.

The Influence of Electro-Technics on the Machine Industry. Kolben. *Zeit. f. Elek.*, Aug. 15 and Sept. 1.—A reprint of a recent lecture showing the effects which the application of electricity has had on a number of industries, chiefly in its application for the transmission of power.

The Development of Electro-Technics. Zickler. *Zeit. f. Elek.*, Aug. 15 and Sept. 1.—An article of a general nature.

British Association Papers. Lond. *Elec.*, Sept. 11.—A list of the papers on mathematical and physical science; also the probable programme of the section on mechanical science.

Electromagnetic Deflection of Rifle Balls. Stuart-Smith. *Amer. Elec.*, September.—Referring to the recent reports from Europe giving accounts of the deflection of a rifle ball when its line of fire is parallel to a circuit carrying a heavy current, he suggests that the phenomena is not due to the magnetic effect only, but that owing to the rapid rotation of the ball, eddy currents are set up in it which will not only cause a motion toward the wire, but will retard its rotation, thus diminishing its gyroscopic action, after which it will be more easily deflected; if this explanation is correct there should be some deflection for lead bullets as well as for iron.

Currents for Therapeutics from Lighting Circuits. Elec. Jour., Sept. 1.—A reprint of the translation noticed in the *Digest*, Sept. 5, describing a universal transformer for this purpose; an abstract of the original was given in the *Digest*, July 25.

Electrotherapeutical Association. Elec. Jour., Sept. 15.—The programme of the sixth annual convention to be held in Boston.

Biographical History of Electricity. Amer. Elec., September.—Galvani, Cavendish, Robespierre and Marat are the subjects of the present installment. A portrait of Galvani is included.

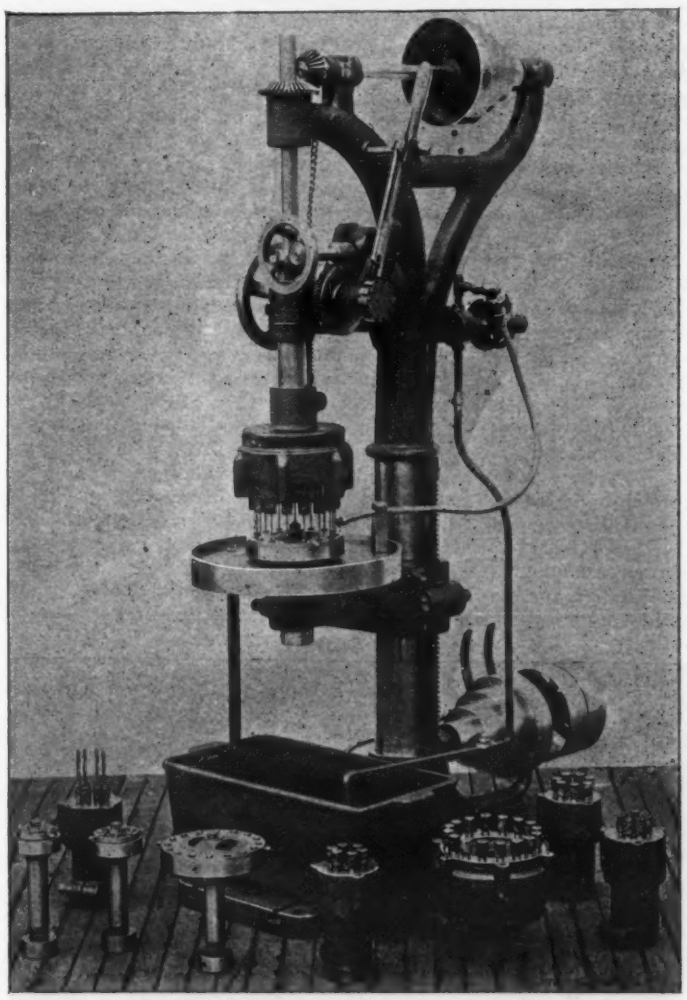
Biographical. Elec. Eng., Sept. 23.—A brief biography and a good portrait of Prof. Henri Moissan, of France, who is noted for his very extensive researches with the electric furnace.

Operating Steam Pumps Without Oil.

The daily press has had considerable to say recently regarding the new torpedo boats for the United States Navy, and particularly about the launching of the first lot of torpedo boats by the Herreshoffs, the well-known yacht builders. Referring to these particular vessels, we learn that the equipment of Blake steam pumps, as well as the main engines, will be run without the use of oil in the steam cylinders. While this is not a new idea, so far as vertical steam engines are concerned, it has, as far as known, never been the practice to run steam pumps without oil. The pumps furnished by the Geo. F. Blake Manufacturing Company, 95 Liberty Street, New York, were arranged without any oil holes whatever, so that it is impossible to get oil into the steam cylinders. These pumps were given an exhaustive test for several days at the works, and they operated with entire satisfaction, and without using a drop of oil. The doing away with the use of oil in the steam cylinders of a vessel is a matter of considerable importance, as there is no necessity of carrying feed-water filters, and no anxiety about oil injuring the boilers.

Multiple Drilling Attachment.

We present herewith an illustration of a multiple drilling machine designed by the Davis & Egan Machine Tool Company, Cincinnati, O., for the rapid production of work requiring the drilling of a definite



MULTIPLE DRILL.

number of holes and at the same time accurately spacing the same. It will be noted that the various heads are furnished to suit the number of holes to be drilled.

The machine consists of a modification of the company's upright drill, in which the drill spindle is used as a driver for the drills which are placed in a head attached to the lower end thereof. The work is clamped to a jig in the table and the drills before touching the work, passing through stud guide bushes, thus ensuring accuracy.

A special pump is provided for lubricating the drills, and the surplus oil is caught by the rim around the table and returned to the pan beneath. The machine is self-contained, accurately fitted and certain of continued alignment.

Possible Removal of the Brush Electric Company's Plant.

It was reported last week that the Brush Electric Company, Cleveland, O., was contemplating the removal of its plant from that city to Lynn, Mass., where it is proposed to occupy one or more of the General Electric Company's buildings, which are not in use at present.

Electric Railways on the European Continent.

The Allgemeine Elektricitäts Gesellschaft, of Berlin, has recently issued a statement setting forth in a tabulated list the various electric railway systems which it has installed since 1891, or is now building—some 34 in number. The table gives the name of the railway company, the length in kilometres of the several lines, the width of track, number of motors in use, number of boilers, horse-power of engines, total capacity of the plants, etc.

Tell-Tale Boards for Signal Lights.

In order to provide safety to the mariner and the ship, underwriters' rules have been framed which stipulate the conditions under which ship lights shall be burned during the night. Where oil lamps are used the duty of one of the watch is to keep a vigilant eye on the lights, but with the introduction on shipboard of electric lamps in which the life of the filament is uncertain, it is necessary to provide some means which will show whether the lamps are burning and which can be referred to any moment with the assurance of an exact indication.

Few electrical concerns have given as much attention to the adaptation of electricity to shipboard use as has the General Electric Company, whose work in this line may be considered to date from the time that Edison installed the first incandescent lighting plant on the old Pacific steamer *Columbia*, to the present day. This company has devised an indicator for the above-mentioned purpose and for which it claims both reliability and simplicity. It is called a "tell-tale" and is placed in a convenient position, generally in the pilot-house, the main wires supply-

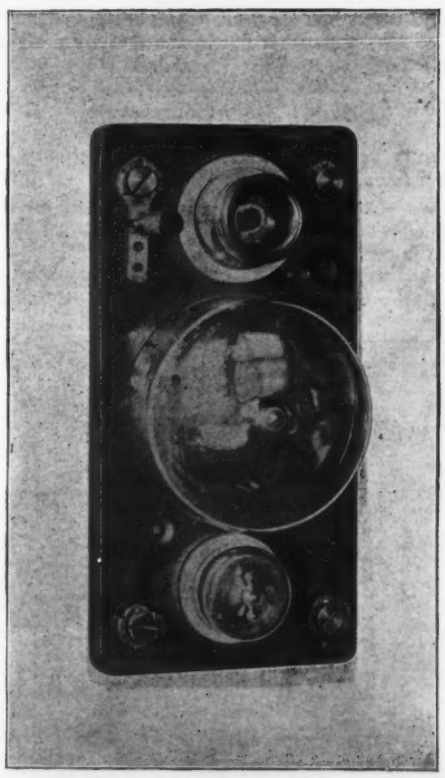


FIG. 1.

ing current for the running light being brought to the two lower binding-posts, positive and negative. From the two upper binding-posts wires lead directly to the lantern. A lamp is inserted in a receptacle at the top of the board and if the lamp in the lantern should go out while current is being carried on the main wires, the lamp on the board will light up and the buzzer in the centre will sound. The snap switch at the bottom of the board cuts all the current from both the board and the running light. To test the indicator the plug at the upper left-hand binding-post is removed, when, if the apparatus is in working order, all the current on the indicator lamp will burn and the buzzer sound; while if the plug is again inserted the running lamp will light up.

Fig. 1 shows a tell-tale board for one lamp and one lantern, but a full

set of indicators can be grouped on one board. Fig. 2 shows a modified form for the two lamps in each of the two lanterns. Should one lamp be extinguished, the current can be immediately thrown into the second

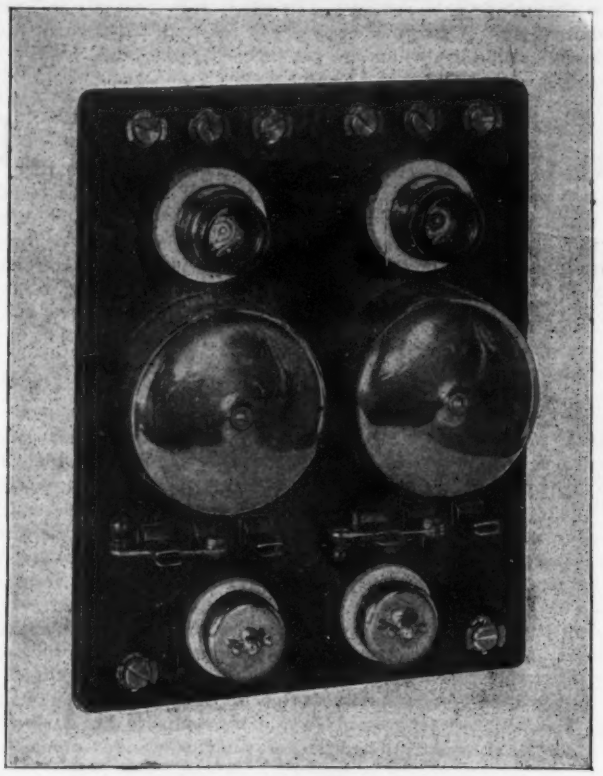
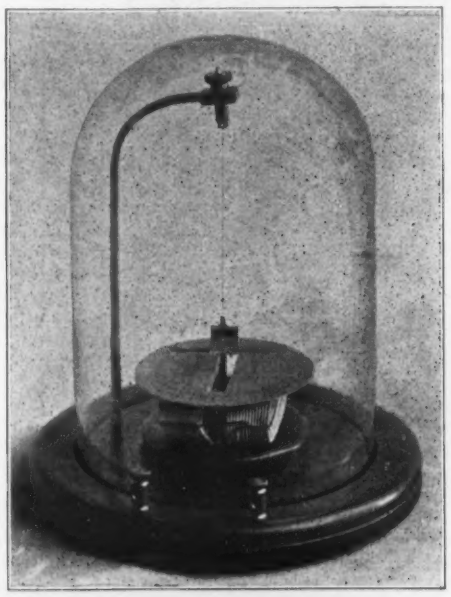


FIG. 2.

lamp by throwing a small knife switch at the bottom of the board over into the other clip. If the blade is not in contact with either clip, the indicator lamp will burn and the buzzer sound.

A Handy Galvanometer.

There has recently been designed in the Institute for Home Study of Engineering, Cleveland, O., a galvanometer for the use of its students, such as is shown in the accompanying illustration. The galvanometer is of the astatic type, the coils of which have a resistance of about one half of an ohm, so that it may be classed as a low resistance deflecting galvanometer. It is adapted for the detection and measurement of small E. M Fs. and will be found of special value in the measurement



ASTATIC GALVANOMETER.

of currents produced by thermo-electric action and by those due to the earth's field. It is also adapted for use in testing with the Wheatstone bridge. The instrument has a very plain finish but is said to possess all the essential elements of delicacy to be found in more expensive types. The galvanometer is used in connection with a lamp. In a former design a lens was used for focusing the rays on a galvanometer mirror, but a pasteboard hood with a lamp chimney having an aperture on the same level with the flame may be used for projecting the beam of light, which method has been found more satisfactory. Those desiring to obtain further information regarding this instrument may do so by writing to the Institute.

"Self Help."

This is the name of a new paper published by the Correspondence School of Electricity, Scranton, Pa., for the purpose of making known the merits of correspondence instruction in electrical engineering and electric power and lighting. The paper does not state how often it will be published. It will be mailed free to those likely to be interested in self-education, and any one desiring copies can obtain the same on application to the publishers.

Standardizing Incandescent Lamp Bases and Sockets.

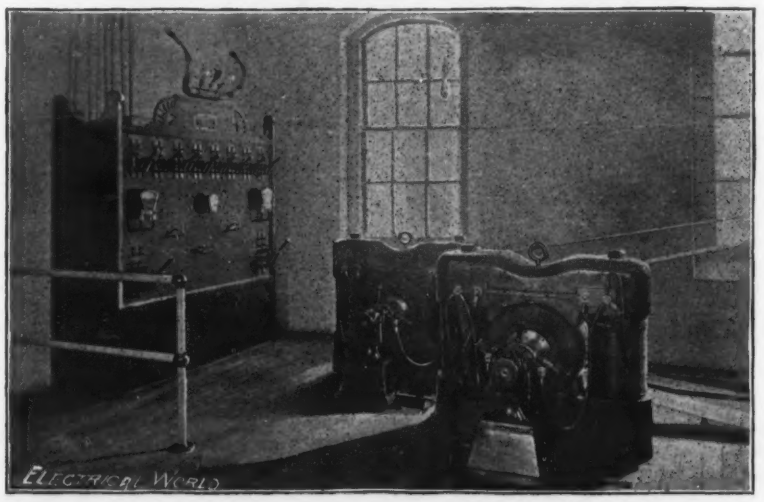
We are informed by Mr. Frederic Nicholls, president of the National Electric Light Association, that a meeting of manufacturers and central station men, to discuss the possibility of standardizing the incandescent lamp base and socket, has been called for Thursday, Oct. 8, next, at 10.30 a. m. The meeting will be held in the rooms of the American Institute of Electrical Engineers, in the Havemeyer Building, 26 Cortlandt Street, New York City.

Mr. Nicholls states that every manufacturer previously advised of the intention to hold a meeting has signified his desire to be represented.

Akron Dynamos at Barberton.

The Akron Electrical Manufacturing Company, Akron, O., has long been a manufacturer of dynamos and motors of pleasing performance and design. The company has adopted the Manchester consequent-pole type of field magnet and uses a ring-wound, smooth-body armature. This type of field magnet, as is well known, is susceptible of very compact design, and a glance at the accompanying illustration of their machines bears evidence that the Akron people have improved their opportunities in this regard. The magnet waists are of wrought iron and the pole-pieces and yokes are of cast iron, thus securing the high permeability and economy in copper in the former and the excellent regulating qualities of the latter. The bearings are self-oiling and self-aligning, as is common in modern practice, and the whole machine embodies all the latest improvements in dynamo design.

The company particularly invite comparison with other machines in reference to slow speed, electrical efficiency, ventilation, mechanical construction and finish. It has been doing an extensive business and is in receipt of a number of flattering testimonials with reference to its apparatus. It manufactures machines from 15 to 1000 light capacity and carries in stock motors from ½ to 50 horse-power, either at 110 or 500 volts. The machines are compound-wound and are automatic in regulation. The speed varies from 1600 down to 600 revolutions per minute, according to the size. The company has been manufacturing machines for about five years, and during that time not one has ever been returned on account of either burned-out fields or armatures, a fact which speaks well for these qualities. The plant shown in the illustration is a 1000-light installed for the Diamond Match Company at Barberton, O. A duplicate of this plant was installed for the Diamond Match Company



DIAMOND MATCH COMPANY'S PLANT.

at Liverpool, England, in March. It is neat, compact and symmetrical. The company has also installed numerous other plants, and its customers are eminently satisfied with the results.

It is pleasing to note that enormous manufacturing facilities and millions of capital are not necessary for the successful manufacture of dynamo-electric machines, but that any machine built upon honor, with careful workmanship and of good material, can be sold at a fair price.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, Sept. 25, 1896.

TELEGRAPH AND TELEPHONE.—These stocks also shared in the upward movement. The following named show advanced prices: Bell Telephone, American Telegraph and Cable, Commercial Cable, Erie Telephone, Postal Telegraph and Western Union, the latter closing with a net gain of 2⅝. The sales of Western Union were 24,262 shares.

ELECTRICAL STOCKS.—These securities, with those of the general list, shared in the improvement of the week, and all closed with substantial advances. The sales of General Electric for the week were 13,314 shares, and the price ranged from 27⅛ to 29⅜, the closing quotation being 28¾; this is a net gain of 1⅝ on the week's business. Edison Illuminating, Electric Storage Battery, both common and preferred, and Westinghouse preferred all show gains.

TRACTIONS.—There was a fair demand for these securities, and with few exceptions, prices advanced fractionally, Brooklyn City being one of the exceptions.

BONDS.—Transactions in street railway bonds are not frequent enough to affect the prices, the only change recorded last week being an advance of 1 point in Huckleberry first mortgage 5s.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked
Chicago Edison Company	100	..	..
Edison Electric Ill., New York	100	93	95
" " " Brooklyn	100	88	93
" " " Boston	100	..	..
" " " Philadelphia	100	..	..
Edison Ore Milling	100	7½	10
Electric Storage Co., Philadelphia	100	29¾	30
Electric Storage, pref.	100	31½	32½
General Electric	100	28¾	29
General Electric, pref	100	65	..
Westinghouse Consolidated, com.	50	22	24
" " pref	50	50	..

BONDS.

Edison Electric Ill., New York	105	100	..
Edison Electric Light of Europe	100	75	85
General Electric Co., deb. 5s	100	86	..

TELEGRAPH AND TELEPHONE.

American Bell Telephone	100	207	207½
American District Telegraph	100	*29	39
American Telegraph & Cable	100	90	91
Central & South American Telegraph	100	124	127
Commercial Cables	100	140	..
Erie Telephone	100	57	..
New England Telephone	100	90	..
Postal Telegraph-Cable	100	78	80
Western Union Telegraph	100	84	84¼

ELECTRIC TRACTION STOCKS.

Baltimore Traction	25	16⅜	16½
Brooklyn Rapid Transit		21	22
Brooklyn Traction	100	..	14
" " pref.	100	46	48
Buffalo St. Ry.	100	64	66
Cleveland Electric Ry.	100	..	..
Columbus St. Ry.	100	40	42
Hestonville	100	48	49
" pref.		..	62½
New Orleans Traction	100	5	7
" " pref.	100	..	50
North Shore Traction	100	22	24
" " pref.	100	72	75
Rochester St. Ry.	..	15	20
Steinway Ry.	..	45	50
Union Railway (Huckleberry)		96	103
Union Traction, rcts $10 pd.	..	12¾	13
West End, Boston	100	68¾	..
" " pref.	100	89¾	..
Worcester Traction	100	14	17
" " pref.	100	85	88

BONDS.

Brooklyn Rapid Transit 5s. 1945	100	72½	..
Buffalo St. Ry. 1st con. 5s	100	101	*104
Cleveland Elec. Ry. 1st mtge 5s	100	100	*104
*Columbus St. Ry. 1st 5s	100	90	*95
Rochester St. Ry. 1st 5s	100	95	100
Union Railway (Huckleberry) 1st mtge 5s		101	*103
*Westchester Electric 1st mtge 5s	100	100	103

* With accrued interest.

DIVIDENDS.—The directors of the American Bell Telephone Company on Sept. 23 declared a regular quarterly dividend of 3 per cent., payable on Oct. 15. This makes a total of 10½ per cent. in dividends declared so far this year, including three regular quarterly dividends of 3 per cent. and one extra of 1½ per cent. Since the company began payment of extra dividends in 1884, 18 extra dividends have been paid, four of 6 per cent., two of 4 per cent., five of 3 per cent., two of 2 per cent., and five of 1½ per cent.

The Edison Electric Illuminating Company, of New York, has declared a quarterly dividend of 1½ per cent., payable Nov. 2.

FINANCIAL REPORTS.—The Columbus Street Railway reports gross earnings for August of $53,515, an increase of $62 as compared with the same month of last year, and net $26,782, a decrease of $2030. The Scranton Traction Railway reports gross earnings for August of $31,653, an increase of $2694 as compared with the same month of last year, and net $13,225, an increase of $1572. For the two months ending Aug. 31 the gross earnings were $64,972, an increase of $7715 as compared with the corresponding period of last year, and net $29,244, a decrease of $595. The Paterson Railway reports gross earnings for August of $31,246, an increase of $1058 as compared with the same month of last year, and net $13,442, a decrease of $1160. For the eight months ending Aug. 31 the gross earnings were $218,849, an increase of $2[illegible],444 as compared with the corresponding period of last year, and net $92,660, an increase of $13,536. The Mexican Telegraph Company has declared a quarterly dividend of 2½ per cent., payable Oct. 14 The statement for the quarter to end Sept. 30 shows: Traffic receipts, $79,090; operating expenses, $16,500; net earnings, $62,590; other income, $9174; total income, $71,764; dividend, $47,815; surplus, $23,949; previous surplus, $500,808; total surplus, $524,757. The Central & South American Telegraph Company has declared a quarterly dividend of 1¾ per cent., payable Oct. 6. The statement for the quarter ending Sept. 30 shows: Traffic receipts, $220,314; operating expenses, $78,000; net earnings, $142,314; other income, $3633; total income, $145,947; dividend, $135,198; surplus, $10,749; previous surplus, $612,108; total surplus, $622,857.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, September 28, 1896.

CORRESPONDENCE SCHOOL OF TECHNOLOGY.—Mr. Max Osterberg, E.E., M.A., consulting engineer, has become associated with the Correspondence School of Technology, Cleveland, O., in the capacity of instructor and representative for Greater New York. The school has recently been developing both elementary and advanced courses, and the addition of Mr. Osterberg to its teaching force will be of value to all three of the electrical courses, as well as to the work in physics and advanced mathematics.

ACCIDENTAL DEATH OF MR. FRANK J. SPRAGUE'S FATHER.—Mr. David Cumings Sprague, father of Mr. Frank J. Sprague, president of the Sprague Electric Elevator Company, New York, was instantly killed on the morning of Sept. 24, at Rahway, N. J. Mr. Sprague attempted to cross the tracks of the Pennsylvania Railroad and in his hurry did not notice an approaching express train. He stepped in front of the rapidly moving train, which struck him, throwing him a distance of 25 feet through the air. When picked up he was dead. Mr. Sprague was born in New Hampshire about 60 years ago. He was at one time manager of the Sprague Electric Railway & Motor Company in Buenos Ayres, South America. Recently he had been president of the Eustis Manufacturing Company of Rahway, and was a member of the Business Men's Club, of Rahway, where he lived. The electrical fraternity at large will sympathize with Mr. Sprague in the untimely death of his father.

ELECTRICAL EFFECTS IN PARADES.—Electrical geniuses should take advantage of the opportunities offered by the parades during the present political campaign to exercise their originality in the way of electrical decoration and effects. The startling electric lighting effects that were produced in one of the big parades during the Blaine campaign in 1884 will be recalled in this connection. On this occasion 600 men in line wore helmets, on top of each of which was a 16-cp incandescent lamp. The lamps were supplied with current generated on wagons which formed part of the parade. The plant consisted of a New York Safety engine belted to a 500-light Edison bi-polar dynamo. The steam was supplied by a fire engine in the procession. The wires were carried by the men in the parade, as they would carry a large rope, and a tap conveyed the current to the lamp on top of the helmet. The effect was decidedly novel in those days. Since then great improvements have been made, and no doubt some very wonderful effects could be produced this Fall. It would be well for some one to take the matter up and show the people what electricity will do in the way of making politics interesting and spectacular.

BROOKLYN INSTITUTE.—The Brooklyn Institute of Arts and Sciences has issued its prospectus for the season 1896-97. In the Department of Electricity eight illustrated lectures on current topics of interest in electricity are scheduled. One lecture will be given on the first Friday evening of each month, commencing Oct. 9, in the following order: "From Coal to the Trolley Car," or "The Problems Connected with the Application of Steam to Electric Propulsion," by J. Lester Woodbridge; "Recent Methods of Electrical Measurements of Precision," by Prof. Samuel Sheldon; "Electricity in its Relation to the Human Body," by Dr. William M. Hutchinson; "The Theory of the Röntgen or X-Rays," by Prof. E. J. Houston; "The Electric Condition of the Atmosphere Surrounding a Wire Over Which an Electric Current is Passing," by Prof. William C. Peckham; "Some New Problems in Electric Lighting,"

by William S. Barstow. Two lectures not yet named are to be delivered by Dr. Charles E. Emery and Mr. Gano S. Dunn. A course of five lectures on the science of electricity will be given on alternate weeks in February, March and April, by Prof. M. I. Pupin. Each lecture will be fully illustrated by experimental observations.

THE GORDON-BURNHAM BATTERY COMPANY, New York, is just placing upon the market a new style of cell which is claimed to be superior for marine purposes, gas engines, fire alarm, parlor car, signal service, and the like. The jar is made of the finest quality of steel, and is lined and covered with the finest grade of blue porcelain. The company, we are informed, is about to improve its ordinary glass cell by the use of heavy opal glass covers in place of tin, and that this company has been placing a number of cells on the Kings County Elevated Railroad. The City of Brooklyn Fire Department is also to adopt them in place of the Samson and Gravity cells. The Delaware & Atlantic Telephone & Telegraph Company has recently completed the installation of its whole plant at Norristown, Pa., with the Gordon cells, and a similar plant is to be installed at Wilmington, Del. The Lehigh Valley Railroad Company is rapidly introducing the Gordon battery in place of all others, and the Hall Signal Company of this city is also substituting this cell for those of other makes, having found after exhaustive experiments and tests that the saving in cost of operation is from 20 per cent. to 30 per cent. over what had formerly been the case.

Buffalo Note.

THE BUFFALO-NIAGARA FALLS POWER TRANSMISSION LINE.—The transmission line between the great electrical plant in Niagara Falls and Buffalo will soon be completed. This will afford the first outlet for the power from the waters of Niagara. Three hundred men are now at work on the enlargement of the power plant, and about 200 more are erecting poles and stringing wires for the transmission line. In a field about 500 feet south of the transformer house 25 men are at work planing off the wooden cross-arms that are to be placed on the poles. These arms are 12 feet in length, 6 inches wide, and on them will be placed the conductors of the transmission line. In the same field are a large number of poles that have lately been brought from Owen Sound in Canada. These poles vary from 65 to 35 feet in length, and are to be placed 600 feet apart. They are to run from the power house along the railway to a point about a mile the other side of Echota. There a turn is made across the railway tracks of the New York Central and Erie roads; about 100 feet on the other side of the Erie the pole line again turns to the south and goes parallel with the railways to North Tonawanda, and at Division Street in that village it crosses the creek to Tonawanda and then to Buffalo by way of the canal. At the city line the pole system ends, and from that point into and throughout the city the wires will be placed in underground conduits. The wire used is six tenths of an inch in diameter. Back of La Salle the poles are all up, and the linemen are hustling up the conductors. The transmission line is complete in parts, and it has been stated by Mr. Brackenridge that it would be ready for current by the 15th of November. The line, it is stated, will be ready by the 1st of November, and all the apparatus is expected in the power house by the 5th of November. Tests of the line and machinery in the power house will be made before the 15th of November. The work on the wheel pit is rapidly progressing. It is to be extended 450 feet westerly. Four engines and 75 men are at work in this pit, 180 feet below the surface, hewing into the solid rock. A gigantic traveling crane carries the rock and earth to the bank above, and on the cars. These cars are taken out beyond La Salle on the Niagara Junction Railway, and the rock is used to fill in the trestle along the line of the railway that runs through the 1700 acres of land belonging to the Power Company. On the bank behind the power house the great stones are being shaped by the stone cutters for the lining of the pit, and the boiler makers are riveting the sections of the new penstocks together. Blasting is frequently heard in the pit below.

New England Notes.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, MASS., Sept. 25, 1896.

REMOVAL.—The Thompson-Brown Electric Company, Boston, has removed to 115 Broad Street, where it has spacious quarters for the transaction of its business.

ENLARGING THEIR FACTORY.—Messrs. Murdock & Taber, Boston, manufacturers of telephones, have recently enlarged their factory space, and are doing an excellent business. They are constantly improving and introducing new styles of telephones. They have recently installed a complete system in Hotel Wentworth, Newcastle, N. H., and 120 telephones in Hotel Langham, Boston.

ELECTRIC POTENTIAL.—On Saturday, Sept. 26, weather permitting, the members of this club will, by invitation of Supt. J. H. French and chief of the electrical department, Col. N. H. Heft, of the New York, New Haven & Hartford Railroad Company, enjoy a day's outing, a social chat and an instructive examination of the "third-rail" system, making for this purpose a trip over the Nantasket Branch of this company, and visiting the power-house connected therewith.

INCREASING ITS FACILITIES.—The Pettingell-Andrews Company, Boston, owing to the continued rapid growth of its business, has been obliged to make some important changes in its salesroom whereby additional space for the storing of its varied stock of electrical supplies and extra facilities for handling the same might be secured. The necessity once realized it did not take long for the fertile minds of General Manager Price and Treasurer Andrews to devise their plans, and such changes have been made which not only afford increased storing space and facilities for the transaction of business, but which have also made the salesroom far more attractive. The executive office is now in the front of the building, instead of the rear, and presents a far more cheerful appearance, as does also the countenances of Messrs. Price and Andrews.

Western Notes.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., Sept. 24, 1896.

MR. T. F. GROVER, superintendent Milwaukee & Wauwatosa Electric Company, has been appointed general manager of the Fond du Lac Electric Light & Power Company, and will assume his new duties on Oct. 1.

HOME STUDY OF ENGINEERING.—The Institute for the Home Study of Engineering, Blackstone Building, Cleveland, O., has just issued a descriptive catalogue of its system of study, giving outlines of the various courses in electrical and mechanical engineering. The catalogue is illustrated and contains copies of several testimonial letters regarding the efficiency of the system.

TELEPHONE CONDUITS.—In the issue of THE ELECTRICAL WORLD of Sept. 19, the paragraph in reference to the new underground conduits being constructed in Indianapolis for the Central Union Telephone Company, stated that the system was that of Mr. John T. McRoy, of Chicago. This, however, was an error. The pipe used in the work is manufactured by the H. B. Camp Company, Aultman, O.

NECKTIE ELECTRIC LIGHT.—The Ohio Electric Works, Cleveland, O., have just placed on the market an electric light for the necktie that is novel and useful. It consists of a one-cp lamp with two small pocket batteries connected, and by pressing a button a light sufficient to read by is given. It is being used on the stage by minstrels and actors, and also by the police and watchmen. It is not a toy, but a useful electric light apparatus.

Pacific Coast Notes.

SAN FRANCISCO, CAL., Sept. 14, 1896.

MR. C. H. PLUNKETT, engineer for the Sprague Electric Elevator Company, has returned to New York, after superintending the installation of the elevators in the Safe Deposit Building and the Parrott Building.

LARGER QUARTERS.—The office and supply house of the California Electrical Works have been moved to 409 Market Street, where the company has more commodious quarters, and better facilities for carrying on business.

ELECTRIC ELEVATORS.—Cahill & Hall, manufacturers of elevators, with works at 214 Mission Street, have completed the installation of one of their electric passenger elevators in the City Hall. The capacity required is one ton lifted 200 feet a minute.

MR. THEODORE E. THEBERATH, of the Stanley Electric Manufacturing Company, Pittsfield, Mass, reported for duty as the electrical engineer for the Pacific Coast, making his headquarters at 106 Market Street in this city, where Mr. John Martin is the local representative.

WATER-POWER PLANT.—Dr. W. H. Garlick and others will establish a water-power electric station, with a capacity of 300 horse-power, which will be used to operate quartz mills in Old Diggings and the Hart mine. Almarin B. Paul, M.E., of this city, is agent for Dr. Garlick.

THE FRASER ELECTRIC ELEVATOR COMPANY.—A Fraser freight elevator driven by two 30-hp motors, installed in the Groesch Building, has given very satisfactory tests. The manufacture of passenger and freight elevators will be actively engaged in at once by this company.

THE REGER & ATWATER COMPANY, of this city, recently incorporated, is now located at 36 Second Street, where a creditable stock of electric railway and other electrical supplies is carried. The Ohio Brass Company, Mansfield, O., is one of the companies represented by the new corporation.

TWO-PHASE APPARATUS.—The Westinghouse Electric & Manufacturing Company has sold an additional two-phase generator of 150-kw capacity, to the Big Creek Lighting & Power Company. The new installation will be a duplicate of the apparatus that is already in operation at the company's plant, which is near Santa Cruz, Cal.

THE ABNER DOBLE COMPANY, representing the Walker Manufacturing Company, Cleveland, O,. has moved its offices, warehouse and engineering works to the new building, which was recently purchased, at the corner of Fremont and Howard Streets. The new works of the company will be probably the foremost in the city, and the electrical apparatus handled will be seen there in practical operation.

THE COMMERCIAL LIGHT & STEAM POWER WORKS, L. C. Watters, superintendent, which has done an extensive business in supplying live steam and shaft power from its plant at 510 Commercial Street, has laid mains for a four-wire system of electrical distribution for light and power purposes. A Stanley two-phase generator, of 90-kw capacity, has been purchased, and a much larger installation is in contemplation.

THE FORT WAYNE ELECTRIC CORPORATION, Fort Wayne, Ind., recently sold through its local district agency to the Mutual Electric Light Company, of this city, one 300-kw alternating generator, having a capacity of 6000 incandescent lights and one 150-light Wood arc machine. A 25-light direct-current machine has been sold to the Union Gas Engine Company, of this city, which will be sent to New Zealand to be operated by a crude-oil engine.

TROLLEY MAIL CARS.—An electric mail car service has been inaugurated in this city on the lines of the Market Street Railway Company. The first car, which has been successfully tested, starts at the new Post Office at the ferry depot. At Greene Street it delivers the mail assorted ready for the carriers to Sub-station J. After delivering the mail to Sub-station C., on Mission Street, it returns to the ferries by the same route, giving the clerks on the car ample time to assort the mail collected *en route*.

THE SANTA BARBARA CONSOLIDATED COMPANY, of Santa Barbara, Cal., has closed contracts for a quantity of supplies, etc., for its new electric railway system. The General Electric Company supplied generator and equipments; John Hammond, San Francisco, four cars; the Washburn &

Moen Company, Worcester, Mass., the wire; the Reger & Atwater Company, San Francisco, the overhead material and the double New Haven cash registers. The present trackage is six miles. C. W. D. Miller is president of the company.

CANADIAN NOTES.

MONTREAL, CAN., Sept. 24, 1896.

LISTOWELL, ONT.—Tenders will be asked shortly for installing an electric light plant in this town.

TORONTO, ONT.—A Toronto and Hamilton trolley line is among the possibilities of the near future.

HUNTSVILLE, ONT.—The City Council has passed a by-law in favor of putting in an electric lighting plant.

ST. THOMAS, ONT.—Negotiations are pending for the sale of the St. Thomas Street Railway to a Cleveland company.

MEAFORD, ONT.—A by-law has been passed to authorize the Huron & Ontario Railway Company to construct, equip and maintain a line of railway through the various streets within the limits of the corporation of Meaford.

PERTH, ONT.—The time for beginning the construction of the Perth & Lanark Electric Railway has been extended one year by the Perth Town Council, provided satisfactory guarantees of good faith are given on behalf of the company.

LONDON, ONT.—The Local Street Railway Company is gainer to the extent of from $12,000 to $15,000 by the recent decision of the Privy Council of England, allowing the Toronto Street Railway Company a remission of the duties paid on imported steel rails.

ST. REMI, QUE.—The manager of the Parè & Parè Telephone Company has concluded the purchase of the Richelieu Telephone Company. This line runs from St. Remi to St. Guillaume, Que, and connecting lines, making 262 miles of trunk lines with 47 towns and villages connected together.

ENGLISH NOTES.

(From Our Own Correspondent.)

LONDON, Sept. 19, 1896.

THE SHEFFIELD RAILWAYS.—The railway system of Sheffield recently came into the hands of the Corporation, who, as is usually now the case, is planning large extensions of the system and the adoption of some form of mechanical traction. Of course, electric traction has been mooted, and the usual committee has been appointed to investigate its merits. Electric traction, if it wins the day at Sheffield, will certainly have good cause to congratulate itself, for the streets are narrow and the city, lying as it does in a basin, the gradients from the centre of the town outward are of an extremely heavy description, there being many 5 per cent. gradients on the existing lines, and I understand that on several of the projected lines there are some gradients of as much as 10 per cent.

A NEW HIGH-SPEED ENGINE.—Great activity exists at the Loughborough works of the Brush Electrical Engineering Company in connection with the manufacture of the new "Universal" high-speed steam engine recently invented by Mr. John S. Raworth, chief engineer to that company. New shops are being erected, and from all appearances considerable business is likely to be done in these engines. Three of them are now being built for the Italian navy and a large number of other orders are on hand. Recently a number of engineers and technical journalists traveled down to Loughborough from London to inspect these new shops and to put the engine through a short trial. The result of the trial proved very satisfactory. [A description of this engine appeared in THE ELECTRICAL WORLD of Sept. 26.]

PAINTERS AND CARPENTERS AS MOTORMEN AND CONDUCTORS.—The company which owns the various electric railway lines radiating from Douglas, in the Isle of Man, has adopted a system with regard to its employees which is at once humane and economical, but which, unfortunately, is not likely to be extensively followed. Douglas is a seaside holiday resort much frequented by the Lancashire mill hands, who literally flock there during the Summer months. During the rest of the year, that is to say, for about nine months out of the 12, Douglas is to all intents and purposes deserted. The consequence is that there are a large number of motor cars and trailers running during June, July and August, and only one or two on each section of the system at other times. To avoid the expense and unpleasantness resulting from engaging a large number of men for so short a period each year to act as motormen and conductors, the company has trained its painters, mechanics and carpenters to act as conductors and motormen, so that these men are employed all the year through, for three months on the cars and for nine months in the sheds, painting and repairing and making ready for the Summer season.

THE BRITISH ASSOCIATION.—The Liverpool meeting of the British Association commences this evening, with the presidential address of Sir Joseph Lister, and to-morrow the meetings of the various sections will commence. A number of interesting and useful papers have already been promised, and more are expected. Among the electrical papers I may mention the following: In Section A, (Mathematical and Physical Science) Prof. J. J. Thomson will deliver a presidential address dealing with varous physical subjects, including Röntgen rays and the teaching of science. Mr. W. H. Preece will read a paper on "Disturbances in Submarine Cables"; Dr. J. C. Bose, of Calcutta, one on "A Complete Apparatus for the Study of the Properties of Electric Waves"; Mr. W. M. Mordey, one on "An Instrument for Measuring Magnetic Permeability" and Dr. F. Bedell, one on "The Division of an Alternate Current in Parallel Circuit with Mutual Induction." In Section G, (Mechanical Science) the presidential address will be delivered by Sir Douglas Fox after which the following electrical papers will be read. Mr. W. H. Preece, "Glow Lamp Tests"; Mr. E. W. Anderson, "Notes on Electric Cranes"; Mr. G. B. Cotterill, "On the Liverpool Overhead Railway"; Prof. Mengarini, on "Electric Light and Tramway Systems in Rome"; and Mr. A. R. Sennett on "Horseless Carriages"; a number of these curious and imperfectly evolved inventions will be on show.

General News.

NEW INCORPORATIONS.

THE CITIZENS' TELEPHONE COMPANY, Flat Rock, Mich., has been organized. Its officers are J. Waltz, president; F. L. Edwards, secretary; W. S. Morey, treasurer.

THE PORTSMOUTH & CORNLAND TELEPHONE COMPANY, Norfolk, Va., has been incorporated. The promoters are C. R. Johnson, president and Annie Hodges, secretary and treasurer.

THE AJAX ELECTRICAL MANUFACTURING COMPANY, Brooklyn, N. Y., has been incorporated with a capital stock of $50,000. The incorporators are T. C. R. Horsfield, A. S. Willdigg and W. D. Spelman, Brooklyn, N. Y.

THE DENVER, SOUTH PARK & HILL TOP RAILWAY COMPANY, Denver, Col., has been incorporated with a capital stock of $100,000. The incorporators are Thomas F. Dunaway, Frank Trumbull, B. H. Dubois and others.

THE IMPERIAL ELECTRIC COMPANY, Westfield, N. J., has been formed for the purpose of manufacturing and installing electrical machinery. The incorporators are W. B. Elliott, J. W. Eskholme, Westfield, and H. J. Linder, Brooklyn, N. Y. Capital stock, $60,000.

THE CONNELLSVILLE SUBURBAN STREET RAILWAY COMPANY, Connellsville, Pa., has been organized to build an electric railway between Connellsville and South Connellsville. Capital stock $25,000. The directors are S. R. Slaymaker, P. S. Newmeyer, and John Scisson, all of Connellsville.

THE SAN LUIS POTOSI ELECTRICAL COMPANY, Charleston, West Va., has been incorporated by Charles H. White, New York City; Justin D. White, Newark, N. J., and Frederick J. Curnick, New York City. Capital stock, minimum, $500. This company is formed for the purpose of acquiring, maintaining and operating electric power plants, and especially for operating the electric plant known as the Companie Potosine de Alumbrado Electrico, situated in the City of San Luis Potosi, Mexico.

TELEGRAPH AND TELEPHONE.

CHILLICOTHE, O.—The Central Union Telephone Company will construct a new metallic circuit line from Chillicothe west to Greenfield, Hillsboro and Williamsburg, where direct connection will be made for Cincinnati.

DES MOINES, IA.—The Mutual Telephone Company, which was recently organized, announces having secured enough patrons to ensure the introduction of its system, and promises to be ready for business by January next.

LA PORTE, IND.—It is reported here that Eastern capitalists are interested in the building of a long distance telephone line in the States of Indiana, Michigan, Illinois and Ohio, in opposition to the Bell Company. Sufficient capital, it is reported, is behind the project to make it a formidable rival.

COUNCIL BLUFFS, IA.—The new telephone line between this city and Oakland has been completed, and is now open for business. The line will be extended to connect all of the smaller towns in the eastern part of the county with Council Bluffs. Tests on the lines give very satisfactory results.

BOSTON, MASS.—The Erie Telegraph & Telephone Company is rapidly extending its long distance service in the Northwest. The total length of wire already strung is 1390 miles, and the extent of the territory is from Sioux Falls to Minneapolis and Fargo. The company will build in all 1600 miles of pole line this Summer, and string about 5000 miles of copper wire. In the Southwest the circuit between Houston and San Antonio is approaching completion, and eight wires are now working between Sherman and Austin, nearly 300 miles, with branches at every important point.

ELECTRIC LIGHT AND POWER.

NEVADA, MO.—Nevada is contemplating putting up a plant to be owned and operated by the city.

ROSEVILLE, ILL.—A franchise has been granted to J. W. Stevenson for an electric light and power plant.

MARLIN, TEX.—R. G. Wello and Ed. Schimming have asked for a franchise to erect an electric light plant to cost $8000.

MILLSTADT, ILL.—The citizens of Millstadt have voted in favor of issuing $5,000 of bonds for the construction of a municipal electric light plant.

BAINBRIDGE, N. Y.—It is stated that the electric light company at Sidney, N. Y., will extend its lines to this place to supply our people with electric lights.

OCALA, FLA.—The City Councilmen of Ocala contemplate erecting an electric light plant for the city, at a cost of not less than $15,000 or probably $20,000.

QUINCY, MICH.—The Council has granted a 15-year franchise to Rheubottom & Bond, of Union City, Mich., for a complete central-station electric lighting plant.

DOVER, N. J.—The Dover Electric Light Company has staked out the site for its new plant and the contract for the erection of the same will be awarded in the course of a few days.

APPLETON, WIS.—The Appleton Electric Light & Power Company has decided to dispense with the use of water-power for electric power distribution, and in its stead introduce a steam engine.

QUINCY, MICH.—The Common Council granted a 15-year franchise to Rheubottom & Bond, the plant to be run in connection with the city waterworks. Work will be commenced at once.

WILMINGTON, DEL.—Preparatory to the erection of a new station for the Wilmington City Electric Company the work of tearing down the old buildings on West Fifth Street, near Orange, has been commenced.

LINCOLN, ILL.—At a meeting of the Council the Committee on City Lighting was instructed to correspond with the various electric light companies and see what would be the probable cost of a plant carrying from 120 to 150 arc lights.

WOONSOCKET, R. I.—The Woonsocket Electric Light Company is installing a large storage battery plant. It will be used in equalizing the load on the generating plant, and the new equipment will include a booster.

OVID, MICH.—The electric lighting plant which has for several years past been operated by the village is for sale. The authorities would like to transfer the plant to private parties and contract with them for the necessary street lighting.

PORTLAND, ME.—The officers of the Maine Eye and Ear Infirmary have received the perfected plans for the building of an electric power plant, adjoining the infirmary building. The electricity is to be used through the entire building for lighting, power and medical purposes.

SOUTH NORWALK, CONN.—The financial difficulties of the Norwalk & South Norwalk Electric Light Company have been straightened out by the General Electric Company taking possession of the plant. The General Electric Company was the largest creditor. According to the terms of the transfer the old stockholders will secure a continued interest of 40 per cent. of their former holdings.

ST. LOUIS, MO.—It is stated that the opposition to the underground conduit law will crystallize in litigation, and the validity of the bill will be attacked on several grounds, the most important ones being that the compromise clause of the ordinance is invalid, and that the law shuts out all competition in the future. To carry out the provisions of the ordinance some of the companies will have to expend between $500,000 and $1,000,000 in making the changes required. All are already engaged in work on the plans and specifications for the work involved in the new law.

NIAGARA FALLS, N. Y.—It is stated that negotiations have been in progress for several months for the sale of the Erie Canal Traction Company to an English syndicate, for $3,000,000, and Mr. Charlton T. Lewis, secretary and treasurer of the Cataract Electric Construction Company, will meet Mr. William Mertens, president of the company, in London, where the deal will be consummated. Mr. Lewis is reported to have said that the Erie Canal will be equipped from Lake Erie to the Hudson River with a complete cable way system of propulsion, and that the building of a large fleet of steel canal boats is now under way.

BALTIMORE, MD.—The mandamus case of the Edison Electric Illuminating Company against the Mayor and City Commissioner of Baltimore to compel these officials to issue a permit allowing the Edison Company to construct conduits in the city streets, has been decided by Judge Phelps against the Edison Company. The Judge evidently agreed with the Mayor that the privilege to construct conduits could be given by ordinance only. As the city contemplates extending its conduit system so as to accommodate all electric wires and to compel all electric companies to use the conduits, this decision means much to the city. The case will be appealed.

BALTIMORE, MD.—The property of the United States Electric Power & Light Company has been placed in the hands of receivers, on the petition of Thomas J. Cannon and James F. Morrison. Messrs. Charles M. Armstrong and Randolph Barton were appointed receivers on Sept. 16. It is charged that the Brush Electric Company, which controls the property of the United States Company, operates the latter for its exclusive benefit and advantage without regard to the minority partners, and has taken for itself the business and custom of the United States Electric Company. The Brush Company denied these allegations, but admitted that the business did not pay, and practically consented to the appointment of the receivers.

BIDS FOR AN ELECTRIC PLANT.—The following bids were made for an electric light plant in the East Side pumping station in Columbus, O.: The Jenney Electric Motor Company, Indianapolis, Ind., dynamo and engine, $405; F. M. Foster, 40 lights, $50, dynamo and engine, $418; Bissell, Dodge & Co., Toledo, O., 40 or more lights, $1.50 per light; C. H. Burnett, 50 or 60 lamps, $65; Thresher Electric Company, dynamo with Racine engine, $387.20, with Sturtevant engine, $420.20; Fort Wayne Electric Corporation, Fort Wayne, Ind., dynamo and engine and wiring 40 lights, $375; the Triumph Electric Company, Cincinnati, O., dynamo and engine, $463. The specifications provide for a dynamo of not less than 4½ kilowatts, or sixty-five 16-cp incandescent lamps of 50 watts each. It shall maintain a constant potential of 110 volts. The wiring shall be done in accordance with the rules of the Underwriters' International Electric Association; the engine to be of the direct-connected type, either vertical or horizontal.

The Electric Railway.

WEST CHESTER, PA.—It is now known that the proposed trolley line from Pottstown to this place is to be built, if not entirely this Winter, it will at least reach Kimberton or some point near there.

BALTIMORE, MD.—An ordinance which was introduced in the City Council is intended to provide additional street railway facilities for that section of the annex between Walbrook and Electric Park.

MASSILLON, O.—At the meeting of the Massillon Board of Trade, a proposition to loan the Canton-Massillon Street Railway Company $20,000, for the purpose of building a line to Nevarre, met with favorable consideration.

SAVONA, N. Y.—The trolley road from Savona to Wayne is now considered to be nearly a sure thing, and will probably be built before Winter on the broad gauge plan. The road will be over the roadbed of the Sodus Bay, Corning & New York Railway, and will eventually be extended to Penn Yan.

BROOKLYN, N. Y.—The recent rumor that the Nassau Railway Company was about to be sold to an English syndicate is stated by President Albert Johnson to be without foundation. President Johnson declares the report to be a ghost story, and the company instead of selling out is trying to increase its system.

SAGINAW, MICH.—It is reported that two electric lines will connect Bay City and Saginaw. F. J. F. O'Keefe, attorney for the Rapid Transit Company, which recently received a franchise by the Council, says the officers of the company are pleased with the ordinance and will soon be in the city for the purpose of accepting it.

GARDNER, MASS.—Col. Asa P. Kneeland, of Worcester, says that he has secured $60,000 of the $100,000 necessary to build the electric railway from Gardner to this city, and will commence work as soon as he can get a franchise from the town of Westminster. This line is a part of the Westminster & Mt. Wachusett Railway scheme.

JOHNSTOWN, PA.—At the last meeting of the Johnstown Board of Trade, a committee was appointed to take in hand the proposed road from Johnstown to Armagh. The members of this committee are: T. C. Dupont, John Fulton, M. B. Stephens, W. H. Matthews and N. F. Thomson. The matter will be arranged at once, and the road built in the near future.

WAUKEGON, ILL.—The Board of Supervisors has granted the petition of the Bluff City Electric Street Railway Company for permission to lay and operate a railway along the highway adjacent to the Chicago & Northwestern Railway, to the corporate limits to the village of Lake Bluff, except that portion lying within the corporate limits of the village of North Chicago.

NORRISTOWN, PA.—A petition addressed to the Union Traction Company is being circulated for the signatures of residents of Montgomery County, along the Norristown & Chestnut Hill Railway, praying the Traction Company to extend its line from the terminus at Chestnut Hill, to St. Joseph's Convent, and make a connection with the Norristown & Chestnut Hill Line.

BALTIMORE, MD.—An ordinance has been granted to the Baltimore & Ohio Railroad Company authorizing it to use electric motors on its tracks in East Baltimore. The railway company believes that it can handle its cars on the sidings much more easily, and at the same time with a great deal less annoyance to the residents of the streets through which the tracks are laid.

NEWARK, N. J.—The Consolidated Traction Company has been trying to solve the problem of a nature recently exemplified by one of its conductors, who, being one year in the company's employ, receiving wages at $2 per day, managed to accumulate in that time $1000. Failing in the task, the company has had the conductor arrested on the charge of swindling the company by means of transfer tickets.

BUFFALO, N. Y.—The Buffalo Railway Company has rejected the proposition of the Post-Office Department for the carrying of mail over the company's lines according to the specifications of the department. The proposition was to pay the company 12 cents a car mile, and Mr. Littell, the general manager, declares that the company could not afford to accept the Government's terms, even if special cars were not necessary.

CINCINNATI, O.—The Cincinnati Street Railway Company has fitted up a number of excursion trolley cars in a comfortable and luxurious manner for the use of parties. Both open and closed cars for Summer and Winter use are provided. All parties using these cars and passing Chester Park are given free admission to the park. The charges for the use of excursion trolley cars are $5 for the first hour and $2 for each succeeding hour, or $10 for a morning, afternoon or evening ride, consuming not more than five hours.

NEW HAVEN, CONN.—In his annual report of the affairs of the New York, New Haven & Hartford Railroad Company for the year ending June 30, President Clark makes an interesting statement regarding the experiments with electricity as a motive power on some of the branch lines of the company. He refers to the extension of the electric system and states that on the South Shore Branch of the Old Colony Company's lines the current has been successfully and economically conveyed by the third rail system. The results he states have surprised experts, and it is probable that a third rail will be laid at various points upon the company's property during the present year.

NEW YORK, N. Y.—The Third Avenue Railroad Company applied to the State Board of Railroad Commissioners for permission to change its Kingsbridge extension from cable to electricity. The application was opposed by ex-Lieut. Governor Sheehan and Henry Robinson, who represented the Metropolitan Traction Company and the Union Electric Railway Company. Mr. Sheehan claimed that the Third Avenue Company had not secured the consent of property owners in the Van Cortlandt Park section. Mr. Lauterbach, who represented the Third Avenue interests, said that the only reason they came before the Commissioners was that the Common Council had suggested that he ascertain from the Board the propriety or impropriety of substituting the overhead trolley for the cable. That was the only question at issue.

BOSTON, MASS.—The Street Railway Committee reported favorably upon the petition of the Wellesley & Boston Street Railway Company for a single-track location upon Washington Street, West Newton, from Margin Street to Nonantum Square, parallel with the tracks of the Newton Street Railway Company, and an order granting this valuable franchise was unanimously adopted. The petition of the Newtown Street Railway Company for a similar location for second track was refused, and permission given it to relocate its present track. The franchise given the Wellesley & Boston Company provides for a 5-cent fare over the entire length of its line, from Newton to the Wellesley line at Newton Lower Falls, and stipulates that through cars must be run for a single fare of 5 cents between Newton and Newton Upper Falls, and between Newton Centre and Newton; also between Newton Upper Falls and Watertown.

Trade and Industrial Notes.

PORTABLE KEYSEATER.—John T. Burr & Sons, Kent Avenue and South Sixth Street, Brooklyn, have just issued a little catalogue and price list of the Burr portable keyseater. It illustrates the device and sets forth the utility of the same.

THE WALDEN ELECTRICAL SUPPLY COMPANY, Walden, N. Y., has recently purchased the electrical supply business of the Fowler Hardware

Company. The Walden Company is in the market for electrical goods of every description.

THE NASSAU ELECTRIC MANUFACTURING COMPANY, 127-131 Twenty-fifth Street, Brooklyn, has just completed a new and handsome switchboard for the Star Theatre, Brooklyn. This company manufactures the well-known "Baehr" quick brake switch, switchboards and electrical specialties.

WORK RESUMED.—The Westinghouse Electric & Manufacturing Company has resumed work in those departments of its plant at East Pittsburg which were shut down recently. The winding department will also be put into operation. These different departments have been idle for about two weeks.

BALL ENGINE COMPANY.—The Shoenberger Steel Company, Pittsburg Pa., has awarded contracts to the Ball Engine Company, Erie, Pa., and Siemens-Halske Electric Company, New York, for a complete electric power plant, consisting of one 400 and one 150-hp vertical compound engine, direct-connected to 225-kw and 100-kw generators.

THE BLISS SCHOOL OF ELECTRICITY.—The Bliss School of Electricity, Washington, D. C., has just issued its announcement of courses for the term 1896-97. The pamphlet is illustrated with a picture of the school building and views of the different departments, ending with a list and a brief description of the various points of interest in the City of Washington.

STORAGE BATTERY CATALOGUE.—The Willard Electric & Battery Company, Cleveland, O., in a neat catalogue just presented to the trade illustrates and describes the manufacture of its well-known storage battery. Considerable tabulated data of its different types of cells are given. Directions for charging storage batteries, with several diagrams, are given. The pamphlet also gives the prices of the batteries.

PRICE LIST.—Frank H. Stewart & Co., 35 North Seventh Street, Philadelphia, Pa., has just issued a price list of the various goods dealt in by that house. They include switches of all kinds and sizes, cut-outs of all kinds, sockets, shade holders, conduits, insulators, porcelain tubes, lamp cord, wire, cables, brackets, molding, Scheefer wattmeters, transformers, bells, batteries, gas lighting supplies, telephone supplies, etc., etc.

"PIONEER" LAMPS IN THE "BIG STORE."—A signal achievement of the Electric Arc Light Company is the wonderful lighting of the new "Big Store" of the Siegel-Cooper Company, on Sixth Avenue, New York. The "Pioneer" will not need a better advertisement than this brilliantly lighted establishment, where shopping continues after sunset without any disadvantage on account of the new daylight that has been substituted.

THE BEACON LAMP COMPANY'S NEW PLANT.—The entire business of the Beacon Lamp Company, Boston, Mass., has been removed to New Brunswick, N. J. Its new factory in that place is larger than the old one, and is better equipped for the successful prosecution of the business. With these increased and improved facilities the Beacon Company will be in an excellent position to render prompt service. The change of location took place on Oct. 1.

THE AMERICAN STOKER COMPANY, of Dayton, O., has recently perfected a steam motor which is applied to each stoker, thus making each machine independent. This renders the work of installation very simple. It also renders the stoker practicable for use under marine boilers. This company is desirous of a general representation through engineering firms handling pumps, heaters and boiler-room supplies, and invites correspondence from interested parties.

THE FAHY AUTOMATIC OIL PURIFIER, manufactured by V. Clad, Eleventh and Sansom Streets, Philadelphia, is a device which deserves some attention on the part of those operating power plants. Some of the advantages claimed for it are that besides being automatic it wastes no oil, operates independent of the use of any filtering material and combines the features of an oil purifier, oil separator and oil filterer. It is made entirely of metal, and every part may be easily gotten at and cleaned.

LONG-BURNING ARC-LAMPS.—Encouraging reports regarding the success of its long-burning arc-lamps continue to be received by the General Electric Company. A large number are in use in shops, stores, theatres and halls, and they are now being largely purchased by mills, the shadowless light proceeding from the globe rendering them especially valuable for mill work. A few days ago the company issued a handsome little pamphlet on the long-burning arc-lamp in general, and the requests for it have already almost exhausted the edition.

REMOVAL.—The Keeler & Hansell Company, spring manufacturers, 166 Elm Street, Newark, N. J., has taken larger quarters at 9-15 Alling Street, Newark. The increase in its business necessitates this change. The company will have a larger plant and more modern machinery, which will enable it to render quicker service. The new location is adjacent to the freight station of the Pennsylvania Railway and near the Central Railway of New Jersey. The past experience of this concern, in conjunction with its better facilities for manufacturing and shipping, will ensure the best of work and delivery service.

GANZ & CO., Budapest, have recently issued a most beautiful catalogue descriptive of their direct and alternating-current machinery, measuring instruments, arc-lamps and railway apparatus. The volume is handsomely bound, and contains numerous wood-cut and half-tone illustrations. It treats principally of the simple alternating-current machinery, leaving for another volume the application of direct currents and polyphase working. The construction of alternating-current transformers, based upon the Zipernowski, Deri and Bláthy systems, is clearly shown and described. Several installations are described and handsomely illustrated. Among these we note the Tivoli-Rome transmission plant, with several views of street lighting and fixtures in Rome; the central stations at Budapest, Wien, Porta Pia, Venice, St. Petersburg, Innsbruck, Carlsbad, Fiume, Erlau, etc. This is one of the finest catalogues to which our attention has been called.

Business Notice.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 67-71 Park Place, New York.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED SEPT. 22, 1896.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

567,959. PROCESS OF TRANSFORMING CHEMICAL ENERGY OF FUEL INTO ELECTRICAL ENERGY; W. Borchers, Duisburg, Germany. App. filed Nov. 21, 1895. The process of generating electricity consisting in placing a bath of cuprous chloride in a closed circuit, dissolving fuel-gas in said bath of cuprous chloride at one point and dissolving oxygen of the air at another point in the bath.

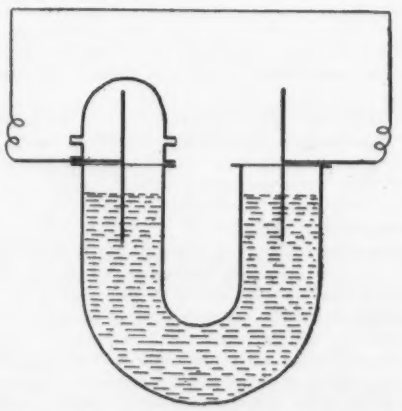
567,966. SUBSTANCE FOR TELEPHONE ELECTRODES; D. Drawbaugh, Eberly's Mill, Pa. App. filed Jan. 10, 1896. The method of preparing substances for use as telephone electrodes, which consists in taking a body of granular or finely divided platinum, treating this with a solution of nitrate or chloride of silver, then partially drying the same, then subjecting it to the action of heat until thoroughly dried and finally subjecting it to the action of sunlight.

567,971. ELECTRIC HAND-LIGHTING GAS BURNER; G. J. Galbraith, Boston, Mass. App. filed June 25, 1896. In an electric hand-lighting gas burner in combination with the burner pillar having a fixed electrode, a plate, its centre cut away and having projections and an arm, both said plate and said arm being loosely pivoted to the burner pillar and to each other, a friction spring, a movable electrode hung in one of said projections, a guide, and mechanism to properly oscillate said plate and arm so as to cause said movable electrode to make and break contact with the fixed electrode at the ignition but not at the extinguishment of the gas.

567,975. TROLLEY AND TROLLEY SUPPORT FOR ELECTRIC CARS; W. Grunow, Jr., Bridgeport, Conn. App. filed Sept. 23, 1895. The combination with the bottom of a car or its truck, of supporting rods which are connected therewith, a frame suspended from said rods, a pressure frame connected with and suspended from said frame, a crank sleeve or shaft mounted thereon, rods connected with said crank sleeve or shaft and with the pressure frame, springs mounted on said rods and operating to depress said pressure frame, and a supplemental or rocking frame connected with said pressure frame provided with a trolley wheel.

567,976. ELECTRICALLY HEATED SMOOTHING SURFACE; W. S. Hadaway, Jr., New York, N. Y. App. filed March 25, 1896. The combination of a heating, smoothing or polishing surface, consisting of a hollow section of metal, a coil of wire included in an electric circuit, a sectional core within the wire coil conforming to its interior outline and means for expanding said core, whereby the coil is removably clamped and held in contact with the interior of the smoothing surface.

567,982. AUTOMATIC DEVICE FOR ELECTRIC CURRENT REGULATION; E. W. G. C. Hoffman, Charlottenburg, Germany. App. filed April 17, 1896. In a relay, the combination with the main magnetic relay-coil, of auxiliary coils oppositely wound to respectively assist and oppose the main relay-coil, a relay contact-arm adapted to be influenced by the said main and auxiliary coils, whereby the said arm is actuated to engage with contacts provided on the said relay.



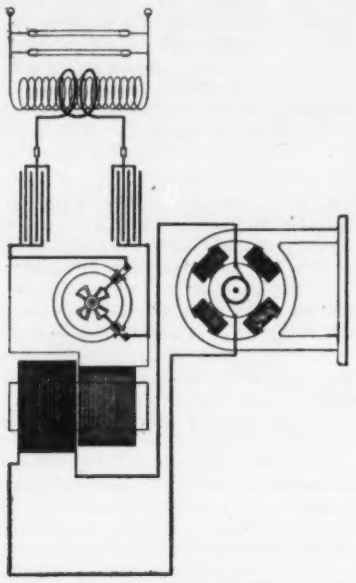
567,959.—PROCESS OF TRANSFORMING CHEMICAL ENERGY OF FUEL INTO ELECTRICAL ENERGY.

567,984. ELECTRIC SIGNALING DEVICE; G. F. Knollmann, Evansville, Ind. App. filed Aug., 1896. In a train signaling system, the combination of a pair of line wires with a plurality of locomotives, each provided with a signal apparatus comprising two pairs of traveling contacts engaging said line wires, a battery having its terminals connected with one of said pairs and a bell having its terminals connected with the other pair, said bell being so adjusted as to be incapable of being rung by its own battery alone

but only when energized by its own battery in conjunction with the battery on another train.

567,989. ELECTRIC BRAKE; A. F. MacDonald, Schenectady, N. Y. App. filed April 18, 1896. In an electric brake switch system, a switch for shifting a dynamo-electric machine or machines employed for braking purposes each time the brake circuit is closed.

568,007. ELECTRIC BATTERY; H. C. Thomson, Boston, Mass. App. filed June 25, 1896. In an electric open-circuit battery, the combination of a carbon element having the neck screw threaded, a cylindrical zinc having projections, a screw rod, a perforated cover having a thread, a slot, a groove and a seat.



568,180.—Apparatus for Producing Electrical Currents of High Frequency.

598,013. MULTIPLE CIRCUIT CLOSER FOR ELECTRIC TRAP PULLING DEVICES; T. R. Barner, San Francisco, Cal. App. filed April 21, 1896. A circuit-closing device for operating mechanically a number of electric circuits in irregular order or succession, consisting of a contact spring for each circuit forming the terminal of one wire of the circuit, a common "ground" or return wire to which all the circuits are connected on one side of the battery, a contact spring forming the terminal of said circuit on the other side of the battery, a revoluble commutator carrying a set of separate insulated contact rings, and a set of insulated contact segments, each contact ring being electrically connected to a contact segment, the said rings and segments being arranged with relation to the contact springs or terminals to make individual contact therewith, means for moving said springs into contact and out of contact with said rings, and means for imparting rotation to said commutator after the contact springs are thrown out of contact therewith, for the purpose of changing the position of said segments with respect to the contact spring making contact therewith, after each time of contact.

568,060. INSULATOR; W. Wood, Middlebury, Conn. App. filed March 11, 1896. An insulator which consists of two separate parts which are tubular in form, one of which is placed within the other, and each of which is provided with an oblong slot which communicated with the central bore thereof.

568,088. APPARATUS FOR CONTROLLING ELECTRIC MOTORS; H. W. Leonard, East Orange, N. J. App. filed April 30, 1896. The combination with an electric motor, of a rheostat, a line-switch closed through the movement of the rheostat contact-lever and means for automatically opening said switch independently of the working positions or movement of said rheostat contact-lever when the energy of the circuit exceeds a certain amount.

568,095. THERAPEUTIC ELECTRODE; J. S. Muir, Stockton, Cal. App. filed April 17, 1896. In a therapeutic electrode, the combination of a flexible backing of non-conducting material, a flexible sheet of electro-conducting material upon the surface of said backing, and a layer of pliable substance or composition of electro-conducting character upon the face of the electro-conducting sheet.

568,103. TELEGRAPH INSTRUMENT; O. M. Runkle, Columbus, O. App. filed June 2, 1896. A telegraph instrument or transmitter, comprising a recessed block to be fastened to the under side of the table, a stem to be passed through the table having a contact-making point on its lower end to operate within the recess of the block, and at its upper end a finger-piece to be operated at the upper side of the table, a spring for holding said stem in position, a bar or plate to close the recess of the block at the under side of the table, and an adjustable contact-making point supported in said bar or plate.

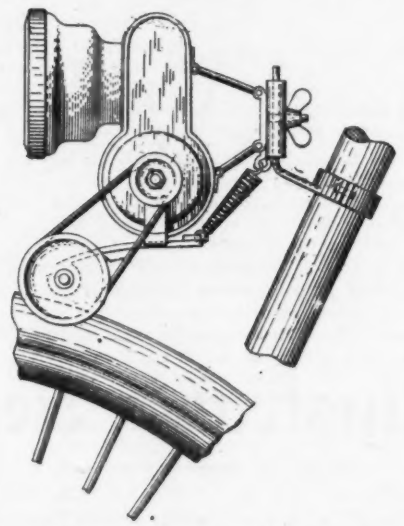
568,168. ELECTRIC CAR-HEATER; J. G. Noyes, Milford, Conn. App. filed April 8, 1896. In a heater organism, the combination of a casing comprising perforated walls having lugs thereon extending inwardly, a removable perforated face-plate having lugs on the inside face thereof, a removable active element or heater proper of such a size as to pass readily through the front of the heater-casing when the face-plate is removed, the said active element resting against the lugs on the walls of the face-plate of the casing, and clips carried by the lugs and resting against the heater proper hold the same in place in the casing, whereby the heater proper will be supported clear of the casing and a circulation of air may be permitted therethrough, while at the same time the heater proper may be removed from the casing after detaching the casing from its support.

568,176. APPARATUS FOR PRODUCING ELECTRIC CURRENTS OF HIGH FREQUENCY AND POTENTIAL; N. Tesla, New York, N. Y. App. filed April 22, 1896. An apparatus for converting direct currents into currents of high frequency, comprising in combination a circuit of high self-induction, a circuit-controller adapted to make and break such circuit, a condenser into which the said circuit discharges when interrupted and a transformer through the primary of which a condenser discharges.

568,178. METHOD OF REGULATING APPARATUS FOR PRODUCING CURRENTS OF HIGH FREQUENCY; N. Tesla, New York, N. Y. App. filed June 20, 1896. The method of regulating the energy delivered by a system for the production of high frequency currents, and comprising a supply circuit, a condenser, a circuit through which the same discharges, and means for controlling the charging of the condenser by the supply circuit and the discharging of the same, the said method consisting in varying the relation of the frequencies of the impulses in the circuits comprising the system.

568,179. METHOD OF AND APPARATUS FOR PRODUCING CURRENTS OF HIGH FREQUENCY; N. Tesla, New York, N. Y. App. filed July 6, 1896. The method of producing electric currents of high frequency, which consists in generating an alternating current, charging a condenser thereby during determinate intervals of each wave of said current, and discharging the condenser through a circuit of low self-induction.

568,180. APPARATUS FOR PRODUCING ELECTRICAL CURRENTS OF HIGH FREQUENCY; N. Tesla, New York, N. Y. App. filed July 9, 1896. The combination with a source of current, of a condenser adapted to be charged thereby, a circuit into which the condenser discharges in a series of rapid impulses and a circuit controller for effecting the charging and discharge of said condenser, composed of conductors movable into and out of proximity with each other, whereby a spark may be maintained between them and the circuit.



568,209.—Electric Lamp for Velocipedes, etc.

568,204. ELECTRIC SIGN; M. Norden, New York, N. Y. App. filed Feb. 28, 1896. The combination with a monogram of incandescent electric lamps and circuit wires to the same, of groups of insulated circuit selecting springs in pairs, to which the conductors are connected, such group being arranged radially, and a contact-bar pivoted at the centre of the groups for closing the circuits to the lamps in the monogram for either sign or letter to be illuminated.

568,205. SIGNAL FOR CABLE RAILROADS; M. Norden, New York, N. Y. App. filed June 29, 1896. The combination with a traveling cable and supports for maintaining it in position of numerous conductors surrounding such cable with their ends closely adjacent but not touching such cable, electric circuit connections from said conductors and an alarm brought into action by a broken strand or projection from the cable.

568,209. ELECTRIC LAMP FOR VELOCIPEDES, ETC.; A. M. Rodriguez, Brooklyn, N. Y. App. filed Dec. 20, 1894. In a lighting apparatus for a vehicle, the combination with a casing or frame adapted to be readily attached to and detached from the vehicle, a dynamo in said casing, and an incandescent lamp in the circuit fed by said dynamo, of a swing frame carried by said casing, a jack-shaft rotatively mounted in said frame, a friction wheel or wheels fixed on said shaft and adapted to bear on the vehicle wheel when the lamp is in position, wheels on the shaft of the dynamo and the said jack-shaft, respectively, and a belt connecting said wheels.

568,262. INCANDESCENT LAMP; J. T. Lister, Cleveland, O. App. filed April 25, 1896. In an incandescent lamp, the combination with a shell of a pair of filaments and circuit terminals therefor, the circuit terminals for one filament being at one end of the shell, and the circuit terminals for the other filament being at the other end of the shell.

568,298. METHOD OF MAKING UNDERGROUND CONDUCTORS; J. H. Croskey and J. Locke, Pittsburg, Pa. App. filed May 21, 1896. The method of making underground conductors for electricity, consisting in forcing molten glass into an envelope cover or casing and around a core having a central core bar or mandrel, then removing the core bar or mandrel and inserting a metallic conductor into the passage or bore formed by the removal of the mandrel.